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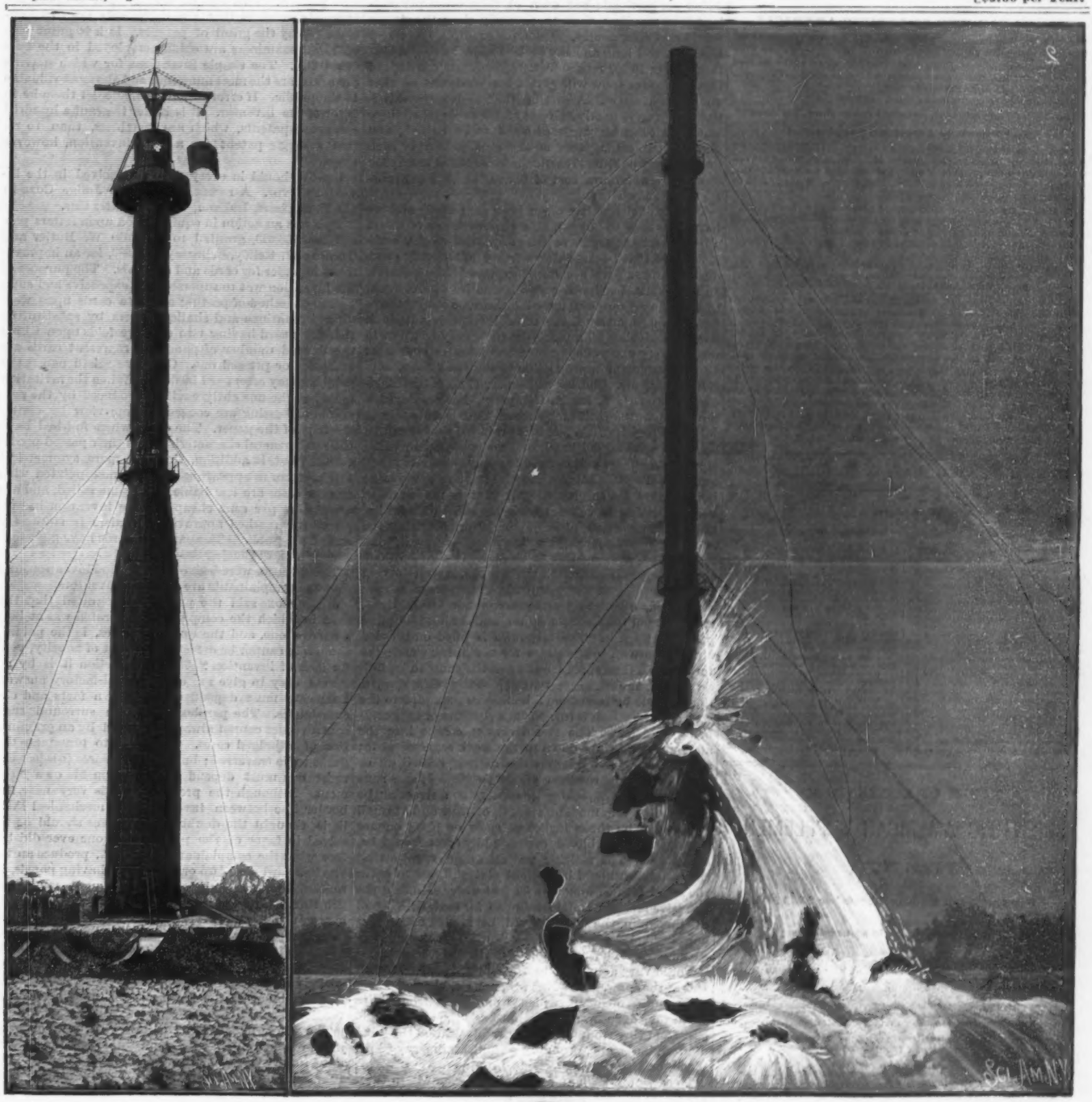

1. Appearance of the tower during the progress of its construction; from a photograph. 2. The tower at the moment of rupture. 3. Appearance of the tower after its fall; from a photograph.

RUPTURE AND FALL OF THE 250 FOOT STEEL PLATE WATER TOWER AT SHEEPSHEAD BAY, N. Y. [See page 405.]

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REMOVAL OF SNOW FROM STREETS.

The difficulty of cleaning the streets not only is perennial, but it is one that becomes more disagreeable, and yet more imperative, with the increase of traffic and the growth of population. The streets of New York are frequently choked by the throngs of vehicles even in the best of weather, and of course a heavy fall of snow makes matters worse. In addition to the trouble thus caused, the accumulations of snow are sources of annoyance to pedestrians, and the filth collected in the slushy mass is a serious danger to health.

The expense of carting away the snow has been variously estimated to range from seventy-five cents to one dollar per cartload; but even at fifty cents per cartload it is manifest that to properly clear the streets would cost enormously. Take, for example, one street block 200 feet long and say 50 feet wide, having a surface area of 10,000 square feet. A moderate snowfall of three inches of snow will give 2,500 cubic feet on that one block of street. Assuming that in loading this is packed down to nearly half—say 1,350 cubic feet—there would be 50 cubic yards of snow to be carted; and allowing two cubic yards as the outside limit of each load, there would be 25 cartloads to be taken from each block, at a minimum cost of $12.50, or $250 per mile, for every snow storm.

The use of steam has often been suggested, and we have described in our columns various forms of steam apparatus, but they have generally failed to give satisfaction, in part because they are not sufficiently expeditious, and in part because they were too expensive. In New York, Lockport, and other cities where steam distributing companies have laid mains, attempts have been made to melt off the snow by turning upon it live steam. This plan melts the snow very fast, but in nearly every experiment there has been an enormous loss of free steam in proportion to the work done.

Recently, Mr. Charles E. Emery, C.E., Chief Engineer of the N. Y. Steam Company, has employed a novel apparatus with such success that it bids fair to solve the problem. While it is probable that it can be operated more expeditiously and economically by using steam taken from underground supply pipes, its use is not limited to this supply. Any locomotive or movable boiler could be employed. All that is needed is to keep the steam in contact with the snow without letting a great portion of it escape before touching the snow. For this purpose a broad, light, rough, and strong sled, with openwork runners, is fitted with a short pipe passing through the top of the sled, having a hose coupling at its upper end. A tarpaulin, or canvas spread, about 25 feet square, made steam tight, extends from the sled as a center, and the hose coupling passes through it. The tarpaulin is piled on the sled until it is drawn to the place for beginning work; the tarpaulin is then spread out upon the snow to its fullest spread, the edges are tucked into the snow, connection is made by hose from a boiler or steam pipe to the sled, and the steam is turned on, a pressure of 40 pounds being sufficient. The steam cannot escape into the air, but is held right down to the work required of it; and in a very few minutes the deepest snowbank or the iciest packed roadbed yields to the heat and runs off as water. By repeating this operation a street can be cleaned in a very moderate length of time and at small expense. The three inches of snow on 10,000 square feet of street on a block, if removed by carts, would be, say, $12.50. The melting process would require that the tarpaulin should be shifted sixteen times to cover the street 200 feet long and 50 feet wide. Making the excessive allowance of 15 minutes for each shifting of the tarpaulin, the street would be melted off in four hours. The cost would depend upon the amount of steam used. That is a difficult matter to calculate, for it would vary according to the temperature of the air and of the snow. The N. Y. Steam Co. charges $1 for 2,000 pounds of steam, which would melt from six to seven tons of snow, and on that basis the steam would cost from three to four dollars per block, and the labor of attendants, etc., probably as much more, say $8 per block, or $160 per mile.

To carry out such an undertaking, even where there are steam mains already laid, would call for a considerable outlay. Steam plugs, like fire hydrants, would be needed on every corner, and each melting would require about 100 to 125 feet of steam hose, capable of sustaining a pressure of certainly over 40 pounds to the square inch, and preferably 80. It is probable that a private company could be organized to do this work. The plan has been successfully operated, and it seems to present a practicable and economical escape from the present disagreeable and dangerous condition of our streets during the winter months.

A GOOD RULE—DOUBT MUST BE RESOLVED IN FAVOR OF THE INVENTOR.

The question is sometimes asked why it is that the examiners of the Patent Office are so liberal in the allowance of patents, especially in simple things. The answer is obvious. It is clearly their duty, under the law, to exercise the greatest degree of liberality toward the inventor, and to do everything in their power to facilitate him in securing his invention by patent. The inventor is a man who supplies the country with new and valuable forms of industry; by means of his new inventions he enables the public to save time and money in the performance of labors, and he supplies the people with all manner of comforts and conveniences. In the earlier days of the Patent Office, the examiners did not so fully appreciate their relations to the inventor as at present.

Many of them were in the habit of officially acting against the inventor by finding flaws in his devices, and rejecting if the thing was simple, or if there was doubt of novelty or reality of invention. They used to act upon the idea that their chief duty was to refuse patents. This was all wrong. The constitution expressly provides that the useful arts are to be encouraged by the grant of patents. It is to grant patents that examiners are chiefly employed in the Patent Office. The simple inventions for which patents are asked are the most numerous and the most valuable to the public. If errors are to be made, let them be in favor of the inventor. It is better to grant a hundred erroneous patents, which are worthless, than to refuse a single patent for a new invention, however simple.

Doubt should in every case be resolved in the inventor's favor. A recent trial before Judge Coxe in the U. S. Court, Indiana, well illustrates this.

This was an action in equity based upon letters patent No. 273,023, granted to Orlando W. Butler and Thomas W. Kelley, February 27, 1883, for an improvement in paper for cards and circulars. The purpose of the invention was to supersede the expensive and cumbersome method of pasting separate cards upon wedding invitations and similar papers by substituting therefor a card having two or more folds upon which the desired number of panels to represent cards are embossed or pressed out. On these raised panels the printing may afterward be done. When the invitation is folded, the unsightly cavities produced by the process of embossing are concealed from view by one of the flaps of the paper. The cards when finished have the same general characteristics as their pasted predecessors; but, in addition, they are more symmetrical and uniform in appearance, can be manipulated with greater ease, are less liable to become soiled, and are about fifty per cent cheaper. The invention has received the marked approval of dealers in stationery and of the public. The patented cards have gone into general use, displacing the old devices referred to.

The defenses were lack of novelty and invention, and that the complainants are not joint inventors.

Judge Coxe said the proof demonstrated that the field in which the complainants operated was at best a narrow one, and the question arises, Is the patent, though it cannot be defeated for want of novelty, void for lack of invention? To this question it is by no means easy to give an entirely satisfactory answer. Each case must depend upon its own facts and circumstances. The perplexities which surround such controversies cannot always be solved by an examination of adjudged cases. The serve to illuminate the paths to be traversed; but he who desires to select the right one must depend largely upon his own judgment. Although the present case is very near the border line between invention and mechanical skill, it is thought the doubt which arises should be resolved in favor of the patent. No one ever did before what the complainants did—viz., produce an invitation card with two or more folds having panels, to represent cards, embossed thereon, upon which the printing is afterward done. This particular structure is new, useful, and inexpensive. It soon became popular; it supplies a need. Time and thought were required in its development. The obstacles which therefore could only be surmounted by skilled labor were entirely eliminated. All this required something more than the labor of the mechanic. It amounted to invention.

The whole matter is well illustrated by a question and answer, quoted with approval upon the defendants' brief. One of the complainants was asked if he thought that prior to October, 1880, persons of ordinary skill in the art would have been unable to produce representations of cards by embossing upon paper, and the answer was: "If they happened to think of it; probably they would not." Exactly so. It is the presence of a thought like this which raises an ordinary mechanic to the plane of the inventor. Invention requires thought; mechanical skill does not. The one is the result of mental, the other of manual, action. Grant that the invention is a simple one, that when viewed from our present standpoint it is hard to understand why the idea did not occur to some one long before, and yet the fact remains that it never did, though something of the kind was long wanted.

After giving the subject the best thought of which I am capable, I am convinced that to relegate these complainants to the condition of mere skilled workmen would be to do them a grave injustice. In the light of the present the idea of substituting hard rubber for other material as a plate for holding artificial teeth, or of providing tubular kerosene lanterns with an irreversible current of air by means of deflectors, seems

simple enough, and yet the men who thought of these things conferred lasting benefits upon the world and received the rewards of inventors.

In *Crandall v. Watters* (20 Blatchf., 97) the patent was for a box loop for carriage tops made of thin metal, from which the loop was struck up. It was used as a substitute for the old leather housing. In sustaining the patent the remarks of Judge Blatchford are so applicable to the case at bar that I quote briefly from the opinion. At page 102 he says:

"Various old devices are introduced. . . . But no article like the plaintiff's, capable of being taken and used for the purposes for which the plaintiff's can be used without alteration and adaptation requiring invention, existed before. Almost all inventions at this day that become the subject of patents are the embodiment and adaptation of mechanical appliances that are old. In that consists the invention. When the thing appears, it is new and useful. No one saw it before. No one produced it before.

"It supplies a need; it is at once adopted; all in the trade desire to make and use it; yet it is said to have been perfectly obvious and not to have been patentable. Where an article exists in a given form and applied to a given use, and is taken in substantially the same form and applied to an analogous use, so as to make a case of merely double use, there is no invention; but it is very rarely that a thing of that kind secures a patent."

There should be a decree for the complainants for an injunction and an account, with costs.

THE ATMOSPHERE OF CAVES.

The largest volume of subterranean atmosphere with which we are acquainted is found in Mammoth Cave, Ky. This cave, or rather system of caves, is very extensive, greatly exceeding the other two notable caverns in our country: the Luray of Virginia and the Wyandott of Southern Indiana. The passageways of Mammoth Cave have a combined length of over 150 miles, and their area covers hundreds of acres. It is estimated that the entire volume of atmosphere thus inclosed exceeds twelve million cubic yards. In this underground world the ordinary atmospheric changes are unknown, summer and winter are unknown, and the heat of the sun never reaches its unbroken night.

Like all our larger caverns, the temperature is alike at all times and seasons. In the summer there is a brisk outward current, having a temperature of 53° to 54°. This current is doubtless fed by certain leakages of air which filter through the sinkholes, which discharge their moisture at certain points in the cave system.

In the winter, there is a current of air setting inward. This is not perceived at a distance of one-fourth of a mile from the entrance. It nevertheless depresses the thermometer a few degrees, and its effect upon the humidity of the air is evident at the distance of three-fourths of a mile.

For the first time hygrometric observations have been carefully made as to this unique body of atmosphere. The dryness of the air has often been noticed, and the resultant niter beds were esteemed a matter of national importance during the war of 1812.

In the "Gothic Gallery," several miles underground, visitors have been wont to deposit their cards, and these cards have remained for years, fresh as new, save where moist finger prints have left behind them the germs of mould. The ground is seemingly dusty, but still the dust, if stirred, will not rise in the air, nor soil a polished shoe. In these portions of the cave, which seemed destitute of moisture, the wet and dry bulbs of the hygrometer showed the same figure, the variations seldom exceeding one-fourth to one-half a degree. The humidity ranged between 96 and saturation. With the thermometer at 54°, the wet bulb would range between 53½° and 54°, and the dew point would be between 53 1/8° and 53 7/8°. The singular fact was noted that the same temperature prevailed at the roof as upon the floor of the cave; and where differences of 200 to 300 feet of elevation occurred, the thermometer would be depressed one or two degrees at the higher as compared with the lower altitude. The humidity would, however, remain a constant quantity. This can be accounted for only on the supposition that the supply of air, slowly admitted from above, is chilled by the absorption of moisture during the first stages of its descent, and becomes slowly warmed before completing its full descent of 300 feet. Mould is rarely seen in the cave, but wherever it occurs, a snowy whiteness and luxuriance of growth are noted.

One avenue of the cave is devoted, with excellent success, to the growth of mushrooms, and no doubt such an atmosphere might have an industrial value for other purposes.

Several consumptives once tried to live, and get well, in the cave. But the result was disastrous. The lack of light was, no doubt, one reason of this; but the hygrometric condition of the air, of which nothing was then known, by greatly retarding healthy perspiration, doubtless hastened the fatal result.

R. NORTON.

DIRECT USE OF STEAM AS MOTIVE POWER OF AEROSTATS.

M. Duponchel, Chief Engineer of *Ponts et Chaussees*, became convinced that the substitution of hydrogen for heated air as the source of ascensional power, while in some respects a progress, had operated to turn aside the new science of aerostation from its natural channel. He believed that the modest Montgolfier balloon of Pilatre de Rozier, carrying with it its own ascensional organ, was nearer to the solution of the problem than the great captive balloon, fresh in the memory of every one. General Meunier, member of the Institute at the beginning of the century, had fully determined the construction of aerostats designed for the transformation of vertical into horizontal motion. For this end he gives the balloon an envelope of fixed shape, with two separate cavities of variable volume, not communicating with each other; but being so constructed that as one expands under any given conditions, the other contracts in exact proportion.

M. Duponchel thinks that he thus will arrive at the solution of the problem of guiding balloons. The school of mechanical solution having only succeeded in constructing toys, and having reached their limit, the study of bird movements must give place to balloon aerostation. To-day, after the results obtained by MM. Tissandier, Renard, and Krebs, the velocity of aerial currents presents the principal difficulty. Upon the surface or under water, a steam vessel capable of reaching a velocity of 19 feet can be master of its movements in the midst of currents never exceeding one-half that velocity; but the aerostat, in the midst of winds whose ordinary velocity is 30 to 40 feet, and which may be as great as 130 or 160 feet in tempests, must be capable of a higher speed if to be used at all times.

M. Duponchel has concluded that a velocity of 60 to 100 feet, enough for all ordinary conditions, could be obtained with a fish-shaped balloon of 700,000 cubic feet capacity, 282 feet long and 70 feet 6 inches high, half filled with hydrogen, and hence having an ascensional force of 26,460 pounds. For velocities of 30, 60, or 100 feet, 60, 480, and 1,620 horse power will be respectively required. It is perfectly evident that no machinery known to us will be available for the production of such power as this in a balloon. But this enormous motive power, though beyond the scope of our machinery, can be obtained from the direct employment of steam as heating agent in a Montgolfier balloon, following in the footsteps of Pilatre de Rozier. Thus, if we inject into a volume of 35,000 cubic feet of hydrogen, contained in the aerostat just described, a quantity of steam sufficient to raise its temperature 78° Fah., its volume is dilated 22 per cent, giving an extra ascensional force of 3,000 pounds, or the equivalent of 700 horse power for one hour. Two systems are described by M. Duponchel. We shall only speak of the first.

An aerial fish of the Meudon model, but with rigid envelope, is the base. Its interior is divided by a flexible membrane into two parts, the upper containing hydrogen gas, that can be more or less expanded by the injection of steam into the lower chamber. Vertical and horizontal fins are used to determine the movements. By shifting ballast the aerostat is inclined and steam is injected, expanding the hydrogen one-fifth of its volume. This causes it to rise and move forward, owing to its inclination. When the gas is cool, the aerostat is brought again into a horizontal position, or inclined the other way, by further shifting of the ballast, and allowed to descend. When near the ground, the ballast is again shifted and the hydrogen heated, so that by a succession of undulations the movement in advance is obtained.

In the case of a balloon of 700,000 cubic feet capacity, the maximum elevation would be 9,800 feet, and the undulations in a distance of seven miles would be gone over in 33 minutes, thus giving a speed of 13½ miles per hour, nearly, with the expenditure of about 350 pounds of coal. This would necessitate renewal of fuel about every 30 miles.—*Abridged from Revue Scientifique.*

PROPULSION FOR OCEAN STEAMERS BY THE STEAM JET.

Having recently in your columns discussed the practicability of the propulsion of boats by using a jet or current of compressed air as our motive agent, the question very naturally occurs, Must we necessarily in this matter limit ourselves to small motors and small boats? If so, the application is somewhat limited, and we fail to take hold of a thing of really general interest.

The plan which I suggested in that article does actually seem restricted in its extension by its own terms.

It involves a reservoir, which is to be filled before starting, and the energy therein stored gives us our limit, and it must, of course, be narrow. A period of a few hours at the furthest is all that we can command. This of itself is certainly of immense practical value; but we will try to look for something better. We need to keep the open sea; we need a power which we can renew incessantly, as we now generate our steam. Can we do it, and still use, in the manner which I have suggested, direct propulsion?

I belive the thing is practicable, and I will try to show it. We may, of course, make use of compressed air for driving our largest ships precisely in the same way as directed by me for the Whitehall boat. It is merely a question of the size of the jet or jets. One-sixth or one-tenth of a horse power, as with the boat, or 1,000 or 5,000 horse power, as with the ocean steamer, what does it matter? If the smallest will do its work, the largest can be equally trusted for its full efficiency. We can certainly employ compressors by means of which the entire power of the steam generated constantly shall be as constantly employed in keeping up a steady pressure in a suitable reservoir, from which the air jet or jets beneath the ship's bottom are supplied, and by which the ship is driven forward, precisely as was the boat. This is surely possible, and if we can drive the boat, we can drive the ship; but this is by no means the plan which it is my object here to propose.

In the double transfer of energy which has been here mentioned, we encounter loss, and it is a loss that seems to me not necessary and not advisable. It is true, we have counteracting advantages which vastly overbalance in their gain the loss which we shall have made, and were there no other way but this, I should be prepared to advocate it most strenuously. We dispense with such an enormous amount of weight in engine and driving machinery, as well as saving the immense space which they now occupy. Our steamers, freed from the huge bulk with which they are now loaded down and lumbered up, would almost double their capacity by the very fact. But, as I stated, the loss by transferring the energy of the steam into that of compressed air I propose to save.

My plan is to propel the ship by jets of *live steam direct from the boiler.* To illustrate and enforce my meaning, I will take a ship of definite size, as I did in the case of the boat. It shall be a steamer which is using in her daily work a constant service of 5,000 horse power. Her boilers supply steam to that extent, and we have it at command. I propose to make no change in them; they go on doing their present work. All that I do is to change the direction of the steam pipe from each boiler. It no longer goes to the cylinder or cylinders. It goes to make its exit as directly as possible by the side of the keel.

This is a mighty change from all present plans. I am prepared to find my views rejected as being entirely unworthy of perhaps even investigation. I am prepared to find them presently adopted in, it may be, modified forms, for I believe that they embody true principles, which will prevail.

My designs in the case of the ship are identical with those which I specified in the case of the boat. The point of exit of the discharge pipe is lateral to the keel; the body of water on which the steam expends its projectile force is, in this instance, three feet in width, the longitudinal confining wall being at that distance from the keel.

In a ship of this size I propose that each jet be matched by one on the opposite side of the keel, and that there be two of these pairs, the first pair being 100 feet from the stem, and the second pair 250 feet. This, then, gives us our system of propulsion. Four pipes of ejection, at the points designated, are pouring forth a torrent each of steam directed backward, and, as before, slightly downward. At each of the orifices the issuing steam exerts constantly a force of 1,250 horse power, for this is what the boilers are steadily supplying. This terrible energy, almost appalling to contemplate, is expended on the open, or rather the confined, water beneath the ship's bottom, and the inevitable result must be a rapid movement of the ship.

No plan can be more simple and compact than this. The theory seems to me without flaw. Its efficiency can be demonstrated only by actual trial. Any one having a steam yawl at command can put the matter to proof with the expenditure of a very few dollars. Without injuring the boat in the slightest, a steam pipe, connected with the boiler, can be passed through her bottom and arranged as specified, and a thorough test made of the *principle*, for, of course, what the yawl will do the ship will do, *mutatis mutandis*, as nearly as yawls and ships work alike in common experience.

The condensation of the steam at the point of impact may be held by some as a source of loss; but, practically, it will be of no moment. The propulsive force of the steam is exerted at the instant of ejection, and not later. The condensation of the steam requires two elements, time and expansion, which are not present.

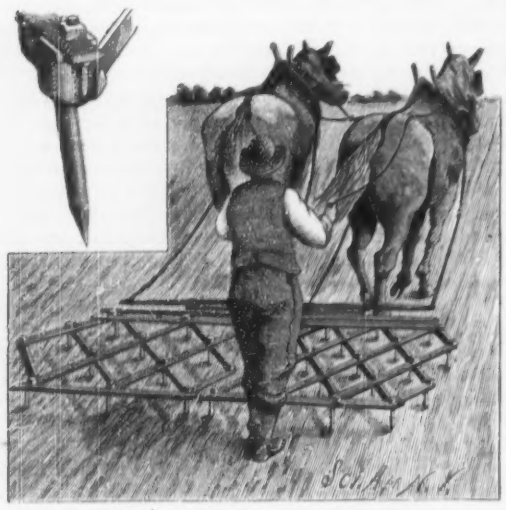
The advantages to accrue from this mode of *direct propulsion by live steam* are so exceedingly great that I most earnestly hope the trial will speedily be made.

W. O. AYRES.

THE first almanac was printed by George von Purbach in 1640.

IMPROVED HARROW.

The frame of this light and strong harrow is composed of flat bars of iron or steel, arranged diagonally in two series crossing each other, the bars of one series being arranged flatwise and those of the other edgewise, the bars being connected with each other and with the harrow teeth by sockets placed on the bars at their intersections. The socket is a casting having a central vertical aperture, with a lateral recess for receiving the right-angled end of the harrow tooth. The lower part of the hole is flared to permit a slight lateral movement of the tooth, which turns on its right-angled arm as a pivot. Upon opposite edges of the surface of the socket are formed ribs, between which is received the bar placed flatwise. Between the ribs a stud projects upward from the face of the socket for receiving the apertured bar and a nut by which the bar is clamped to the socket. Upon the side of the socket is formed a hook for receiving the other flat bar, which is clamped in the hook by the bar placed flatwise above it. One socket is placed at each intersection of the bars. In addition to the diagonal bars, the studs of the end rows of sockets receive apertured bars, which are held in place by the nuts. One of these bars is connected by links or clevises, secured in bolt holes formed in the bar, with the evener by which the harrow is drawn forward. It will be seen that by means of a simple socket at each intersection of the bars they are strongly clamped together, and the teeth are securely held in proper relation to the bars. By arranging the bars flatwise and edgewise, strength and rigidity are secured without undue weight. Any tooth may be readily removed and replaced without disturbing the others. This invention has been patented by Messrs. P. C. & I. A. Carstensen, of Walnut, Iowa.



CARSTENSEN'S IMPROVED HARROW.

IMPROVED CAR COUPLING.

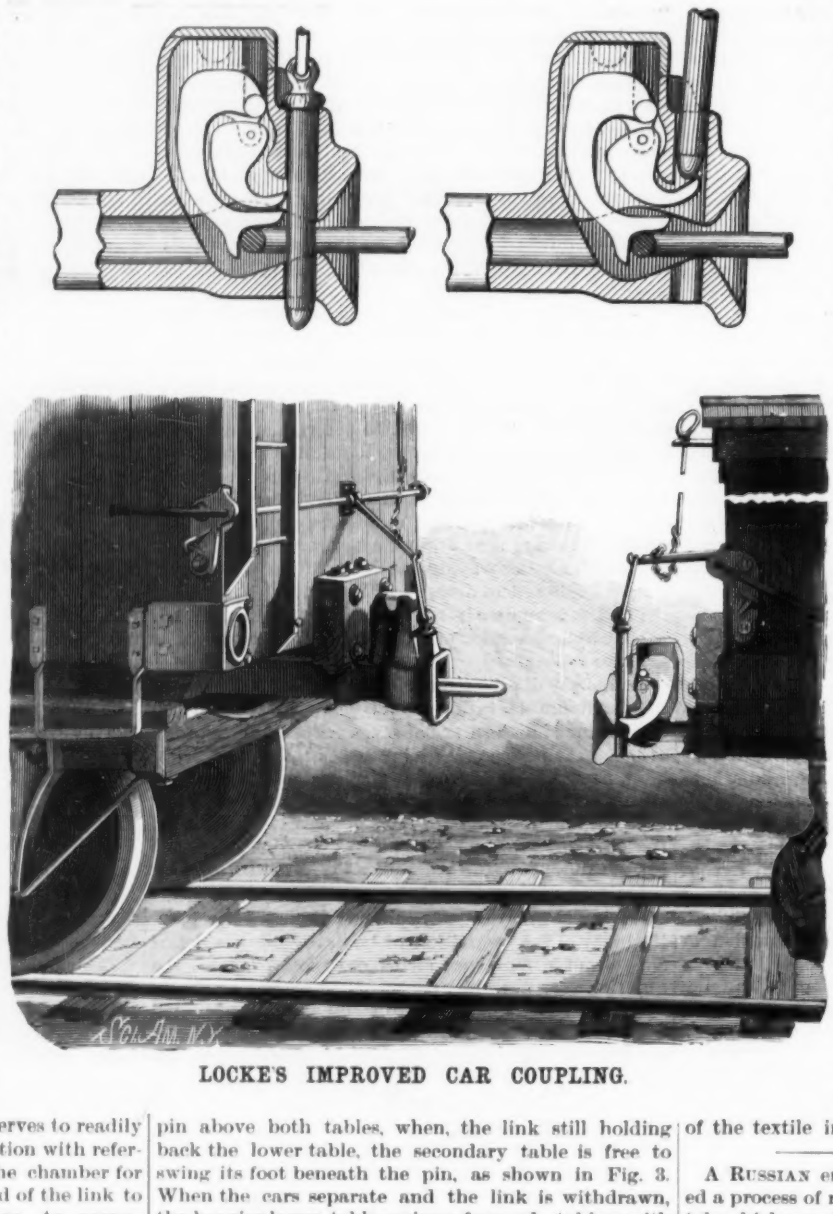
The car coupler herewith illustrated is particularly noticeable for the simplicity and admirable arrangement of its parts. The link is held in a horizontal position, so as to insure its ready entrance into the opposite coupler, while the pin is held elevated by a table which is pushed back by the entering link, through which the pin is then free to drop. The coupler is perfectly automatic in its action, and its reliability is assured, since the parts are so weighted that the force of gravity alone is depended upon. The drawhead opening is so formed as to permit the link to have all necessary vertical and lateral play without subjecting it to any but a tensile strain, thereby lessening the danger of breaking. As the only action required of the brakeman is to lift the pin, and as this can be done from either the sides or top of the car, he need not enter between the cars. The drawhead is provided with a wide flaring mouth terminating in a narrow throat, which serves to readily and certainly guide the link into position with reference to the pin. Beyond the throat the chamber for the link is enlarged to allow the rear end of the link to freely play up and down and sideways, to accommodate itself to the swaying and springing of the cars. Above this wide chamber is a narrow and parallel-sided one opening at the top of the drawhead. This opening is covered by a removable cap as shown. Pivoted in this chamber is a table free to swing, and, being heavily weighted in the rear of its pivot, it gravitates so that its foot or ledge is pressed strongly forward against or under the pin. From the rear portion of the foot a heel projects downwardly into the path of the link as it enters the chamber. Pivoted to the first or primary table just below its trunnions is a second table, which is weighted to gravitate forward, and has a foot lying normally just above the foot on the primary table. When the link is in its proper position in the drawhead, the foot of the primary table rests on its rear end (Fig. 2), the rebyholding its exterior end out horizontally from the drawhead in the position most favorable for coupling with another car.

The construction of the parts is such that the weight of the tables is not always on the link, except when the cars are uncoupled and the link is presented for coupling. The weight of the tables never tends to carry the inner end of the link below the horizontal line; but the link, when the cars are coupled, may swing on the throat of the drawhead as a pivot until its inner end is far below the tables, and so leave the latter entirely suspended on their trunnions in the bottom of the vertical slots, in which they are free to move up and down. These slots or cups are formed at the top and on either side of the chamber, and receive the pivots or trunnions formed on the main table. This construction of the tables, whereby they are pivoted at their top in vertical cups in which they are supported and guided, enables them, when the cars are coupled, to freely swing forward and back or to rise and fall to accommodate themselves without danger of breaking to the thrusting in or jerking out of the link, as well as its frequent sudden elevation or depression, incident to the rocking, swaying, and jumping of the cars.

The pin is operated from either the top or sides of the car by means of a rock shaft extending across the end, as represented in the perspective view.

When in position for coupling, the pin rests on the foot of the primary table; the entering link strikes the hub, crowding it back and withdrawing the foot from underneath the pin, which is then free to fall. To uncouple, it is only necessary to lift the pin above both tables, when, the link still holding back the lower table, the secondary table is free to swing its foot beneath the pin, as shown in Fig. 3. When the cars separate and the link is withdrawn, the heavier lower table swings forward, taking with it the pivot of the upper table, which is thereby pressed against a stop and swung backward to withdraw its foot from beneath the pin, which then falls upon the foot of the primary table, and the parts are again in their first position ready for coupling. It will be observed that the only manual action required is the simple momentary swinging of a side lever against its stop; and that, after it touches the stop, the hand may be instantly withdrawn, the whole operation thereafter, both of uncoupling and coupling, being entirely automatic.

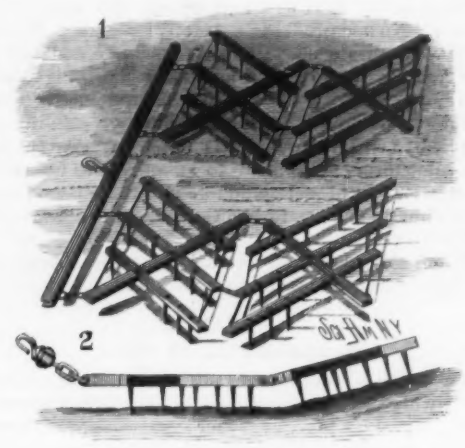
This invention has been patented by Mr. S. D. Locke, of Hoosick Falls, N. Y.



LOCKE'S IMPROVED CAR COUPLING.

IMPROVED HARROW.

This harrow, the invention of Mr. James G. Owen, of Covello, W. T., is made in two double sections, each comprised of front and rear parts, consisting of a series of tooth-carrying bars braced by a diagonal bar, and all connected at the ends of each part by spacing and brace irons. The tooth-carrying bars are set at an angle of about forty-five degrees with the line of draught, the front series ranging backward toward the left, while the rear series range backward toward the right. The front and rear parts of each section are coupled together by hinges, allowing independent vertical movement of all four of the harrow sections, and the front parts of each double section are coupled by suitable flexible bar, link, and staple connections with the draught beam, to which the horses are hitched. The teeth are fitted in the bars in such relation to each other as will cause them to harrow the ground in lines about two inches apart. As the harrow is drawn over the ground, the sections will adapt themselves to any inequalities of the surface in all directions, and no part of the ground will escape the proper action of the teeth. The converging arrangement of the tooth bars, together with the coupling of the front and rear parts by hinges, not allowing lateral play of one part on its connected part, causes the harrow to run truly and effectively on side hills, and without the tracking of one tooth in the path of the preceding one. This harrow is not liable to clog, and does not have a swinging motion from side to side; it may be made of either wood or iron.



OWEN'S IMPROVED HARROW.

Textile Soap.

The firm of Trawitz, Dueringer & Co., Strassburg, Alsace, manufacture a soap for use in the textile industry which it is claimed meets the highest requirements and perfectly replaces the best Marseilles soap. This "Luetzelburg textile soap," as it is named, according to the analysis made in the laboratory of the *Seifensieder Zeitung* contains:

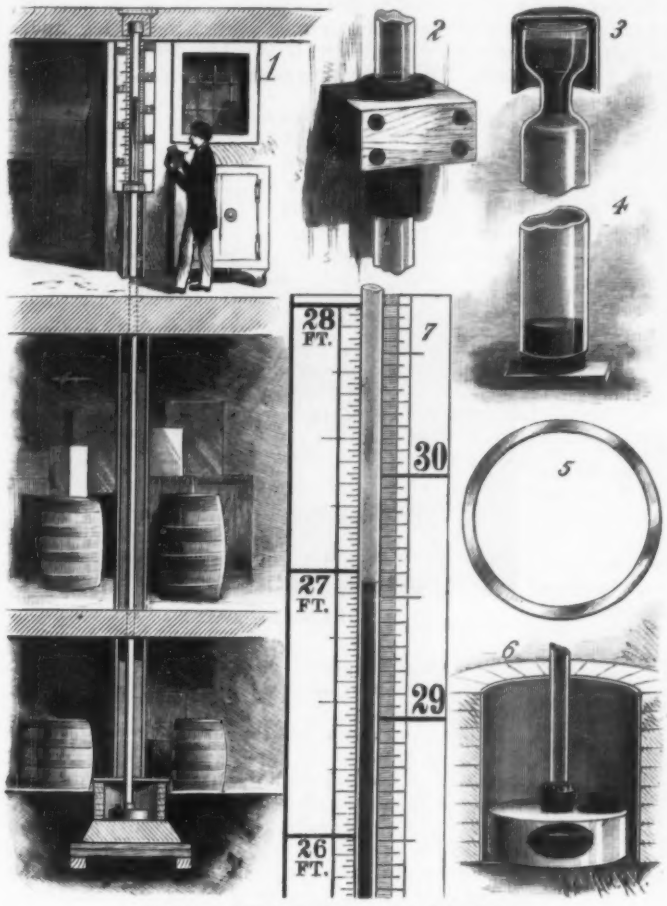
Fatty acid	65·2 per cent.
Soda	7·6 "
Water	27·2 "
	100 "

The fat is completely saponified and the soap absolutely neutral, and therefore suitable for any purposes of the textile industry.

A RUSSIAN engineer reports that he has discovered a process of reducing petroleum to a form of crystals which may be easily and safely transported to any distance and then reconverted into liquid form.

THE GLYCERINE BAROMETER.

Mr. Zophar Mills, Jr., a private merchant of this city, has recently shown a most praiseworthy devotion to science in erecting in his office building, No. 146 Front Street, a glycerine barometer. It is one of three known to be in existence at the present time. To avoid all trouble incident to the employment of joints, a glass tube several feet more in length than the full height of the barometric column of glycerine was used. Some trouble was experienced in procuring the tubes. Two perfect ones were finally drawn by Demuth Bros., Brooklyn, E. D. They are upward of twenty-nine feet in length and of about one inch internal diameter. The section of one is shown in full size in the cut, Fig. 5.



MILLS' GLYCERINE BAROMETER.

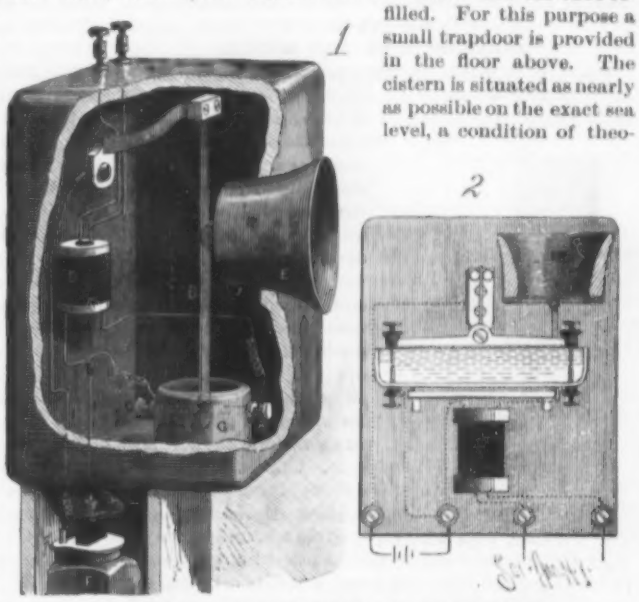
Naturally, trouble was encountered in their transportation from the glass house. Mr. Mills took a personal part in this work. Three men were required to carry the tube in its case. This was not on account of its weight, but because of the danger of breakage if any flexure took place for want of support. Having reached the place of destination, the next problem was the erection of the great inflexible tube into a vertical position within the building.

It was taken up to the roof. Holes were made through the roof and floors beneath large enough to pass it through. It was carefully raised to the vertical and lowered, its lower end passing through floor after floor until it reached the position shown in Fig. 1. The hole in the roof, not over two or three inches in diameter, was then closed. Thus placed, the tube extended from the cellar floor up through intermediate floors and above the ceiling of the second story. The cistern had to be in the cellar, or, rather, below the cellar floor. A watertight pit was prepared for the reception of a flat copper vessel, shown in a larger scale in Fig. 6. The support of the tube had next to be provided for. A collar of brass, with a projecting fillet or shoulder, was made slightly larger in diameter than the glass tube. It was secured to the tube by shellac and by a wrapping of string underneath it and between it and the tube. This collar is held in a wooden block, perforated, so as to catch the fillet, as shown in Fig. 2. The point of support is immediately below the scale. The tube and contained glycerine exert the stress due to their weight entirely on this block only. Or, more correctly, the weight of the tube and atmosphere, the two amounting to about 26 pounds, are here sustained. The lower end of the tube was introduced into the cistern and a cork placed in it and supported by a block. This arrangement can be seen in Fig. 4. Glycerine was then poured into the cistern and into the top of the tube. The shape of the top is shown in Fig. 3. It is contracted, so as to receive a cork. A brass cap is to cover it, to keep out dust. The lower cork being in place, glycerine was poured in through an inclined funnel, about four feet being filled each time. Some fifteen minutes were devoted to this operation. After some hours' standing, in order that all air bubbles might rise to the surface, the next four feet were filled. In this way glycerine was introduced until it stood above the stricture and the tube was quite full. The cork, Fig. 3, which is of India rubber, was then tightly inserted, the lower cork, Fig. 4, was withdrawn, and the column sank, leaving the Torricelli vacuum above it.

This completed the main operating parts of the instrument. A layer of kerosene was poured over the glycerine in the cistern and in the outside cup on the top of the tube, as a further measure of protection. A cover was placed over the cistern, a small aperture being left for the atmospheric pressure to act through.

By accurate measurement, a scale of absolute feet and inches was laid off on one side of the tube. A calculated scale of nominal inches and fractions thereof, referred to the scale of the mercurial barometer, was placed upon the other side. These scales, with the tube between them, are represented in Fig. 7.

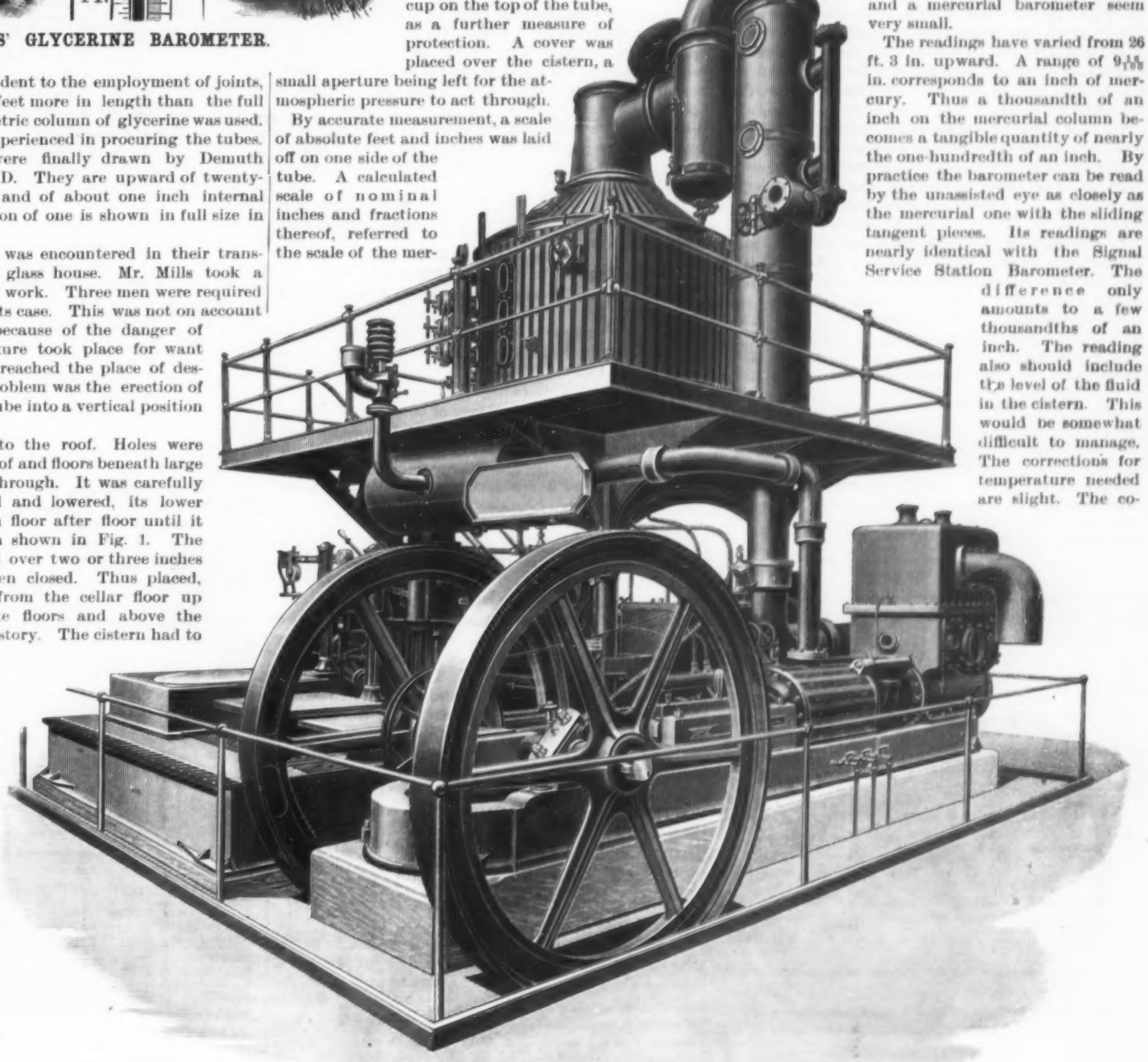
Access can be had from the upper floor to the upper end of the tube. If any air tends to accumulate in the vacuum, the bottom can be corked and the tube refilled. For this purpose a small trapdoor is provided in the floor above. The cistern is situated as nearly as possible on the exact sea level, a condition of theoretical interest as one rarely fulfilled in barometric stations. For constants in laying out the scale, the specific gravity of glycerine was originally taken at 1·250. This would be nearer the truth if 1·265 were taken, assuming the glycerine to be pure. But when it is remembered that the best mercurial barometers do not agree with each other, the chances of obtaining identical readings, as reduced, with a glycerine and a mercurial barometer seem very small.



SARGENT'S TELEPHONE TRANSMITTER.

(FOR DESCRIPTION SEE NEXT PAGE.)

The readings have varied from 26 ft. 3 in. upward. A range of $9\frac{15}{100}$ in. corresponds to an inch of mercury. Thus a thousandth of an inch on the mercurial column becomes a tangible quantity of nearly the one-hundredth of an inch. By practice the barometer can be read by the unassisted eye as closely as the mercurial one with the sliding tangent pieces. Its readings are nearly identical with the Signal Service Station Barometer. The difference only amounts to a few thousandths of an inch. The reading also should include the level of the fluid in the cistern. This would be somewhat difficult to manage. The corrections for temperature needed are slight. The co-



IMPROVED SUGAR EVAPORATING PAN. (For description see next page.)

efficient of absolute expansion of glycerine is 0·00045 for 1° C. In correcting a barometer, the absolute coefficient is the one to be used. Messrs. Black & Pflster, now of the Draper Manufacturing Company, of 152 Front Street, were the instrument makers who assisted in its construction.

COMBINED HOOK AND BUCKLE.

The wire of which the main portion of the buckle is made is bent to form an oblong loop, with parallel arms projecting from one of the longer sides; these arms are curved over toward the loop and provided at their extremities with eyes. The tongue is formed of a wire pointed at one end, and provided with an eye at the other end, which is placed between the eyes of the arms; a wire, forming the pintle of the buckle, passes through the eyes and has its ends bent over to hold the parts in proper position. The arms form a double hook for the reception of the link of a chain, a ring, or a wire rope, while the tongue may be used in the same manner as the other buckle tongues for engagement with the strap, a link of a chain, or a loop in a wire cord or rope. This buckle is useful for application to harness and saddles, and for the temporary repairing of straps and various kinds of rigging.

Further particulars can be obtained by addressing the inventor, Mr. James J. Pinkham, of Stillwater, Montana.

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COTTON CHOPPER.

This cotton chopper is so constructed that the cotton will be chopped to a stand as the machine passes along the rows of the plants, leaving the hills of the plants at uniform distances apart. The axle revolves in bearings in the lower ends of hangers, whose upper ends are attached to the lower side bars of the frame. Upon the inner ends of the hubs of the drive wheels are formed ratchet wheels, with which engage pawls pivoted to the outer ends of arms, and which are held against the wheels by springs. The other ends of the arms are held to the axle by set screws. To the axle is attached a large beveled gear wheel, which meshes with a wheel on a shaft mounted so as to have a movement in the direction of its length. The forward part of the shaft is squared, and to it are secured two parallel slotted bars in which fit lugs formed on the ends of the shanks of the chopping hoes. The shanks are thus prevented from turning, and the hoes can be adjusted, by loosening the nuts of the holding bolts, to work deeper or shallower in the ground as may be required. By means of a suitably arranged lever, placed within easy reach of the driver, the shaft can be moved longitudinally, so as to throw the forward gear wheel into or out of gear with the main wheel mounted on the axle. The chopping hoes can thus be made to revolve or can be held stationary whenever required.

PULS' COTTON CHOPPER.

This invention has been patented by Mr. E. C. A. Puls, of New Braunfels, Texas.

TELEPHONE TRANSMITTER.

In the engraving upon preceding page, Fig. 1 represents a liquid transmitter, which is so wired that in its normal state the current circulates around the induction coil, D, with its full strength. The reason for this is thatthe vibrator is then nearer the screw, A, than the screw, C. The vibrator is actuated by the diaphragm of the mouthpiece, E, and its lower end enters, between the points of the screws, A C, the conducting liquid contained in the non-conducting vessel, G. It is evident that the strength of the current passing around the induction coil will be governed by the variations of the distances of the vibrator between the screws, and which are due to the action of the diaphragm in the mouthpiece. One of the many ways of wiring the instrument is clearly shown in the engraving. Another is to connect the wire leading from the positive pole of the battery where the negative wire is shown connected, and connect the negative wire with the wire of the screw, A.

Fig. 2 shows another construction of the transmitter, in which the vibrator consists of a centrally pivoted lever, which is actuated by the diaphragm in the manner illustrated. Each end of the lever carries a screw that projects downward into the liquid, so as to face a screw passing through the bottom of the vessel. The distance between each pair of screws will thus be varied by the movement of the diaphragm, and the strength of the current passing through the coil will be regulated accordingly.

This invention has been patented by Mr. F. G. Sargent, of Graniteville, Mass., who will furnish any further information.

IMPROVED SUGAR MACHINERY.

Among the exhibits in the machinery department of the Edinburgh International Exhibition, one of the most conspicuous is that of Messrs. A. & W. Smith & Co., Eglinton Engine Works, Glasgow, a specialty of sugar machinery.

The most conspicuous object in the group is a vacuum pan for the finishing process of boiling and crystallizing the sugar, of which we give herewith an illustration from *Engineering*. The heat is imparted by steam to the contents of pan through an inner bottom of copper and by a series of copper coils or worms; and the operation is conducted *in vacuo* by means of a neatly designed horizontal vacuum pumping engine.

This pan is mounted on a elevated platform (for convenience in discharging its contents into the hopper of the centrifugal sugar-drying machines), and the body and top of the pan are lagged by ebony and whitewood; the fittings and gauges are of argozoid, a new white metal, which gives the whole apparatus a very attractive appearance. The discharge of this pan is equal to six tons of dry sugar. The sugar, after having been concentrated and crystallized in the vacuum pan, is run into the hopper or mixed over the centrifugal sugar-drying machines of improved construction.

These machines are on the well-known self-balancing suspended principle, the cylindrical baskets which receive the sugar revolving at a high speed, and purging the sugar from any molasses which it contains. Each basket dries one cwt. of sugar at a charge. The dried sugar is discharged from the bottom of the baskets on to conveyers or bogies, as the case may be.

MERCURY BUBBLES.

BY T. O'CONOR SLOANE, PH.D.

Lord Rayleigh, in one of his recent addresses before the British Association for the Advancement of Science, made an interesting allusion to soap bubbles. He declared that one of the unsolved problems in natural science is comprised in the question, why soap and water form almost the only solution out of which reasonably large bubbles can be blown.

Both the formation of bubbles and globules can be produced with mercury exactly as with water. A quantity of the metal is placed in a vessel of glass, and water is poured over its surface to the depth of an inch. From a bottle more mercury is now poured into the vessel. The height of fall should be about six inches. As the falling fluid strikes the mercury in the vessel it acts as water falling into water does, with one exception. The latter carries air under the surface, forming bubbles filled with air. The falling mercury, instead of carrying air in its descent, forces water under the surface. Mercury is thirteen times as heavy as water. The water thus carried down instantly rises,

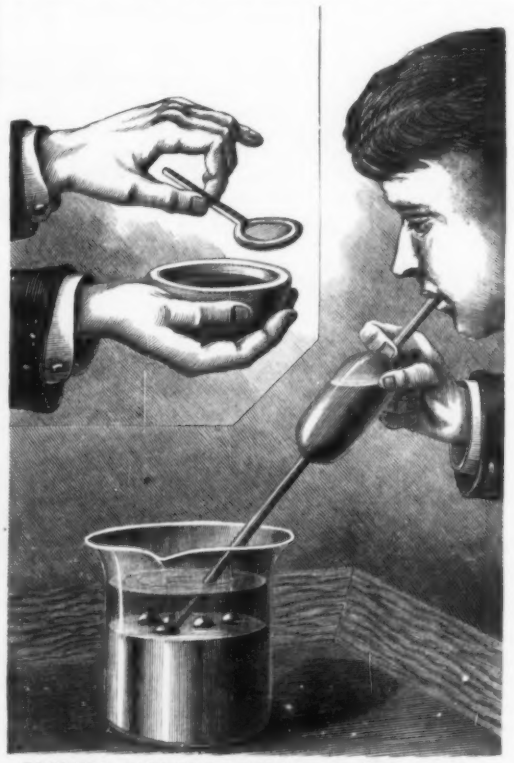
MERCURY FOAM.

and the exact reciprocal of the action described in the case of water and air takes place with mercury and water as factors.

As the water rises above the surface of the mercury on account of buoyancy, it picks up and raises a film of mercury. A hemispherical bubble is formed upon the surface of the fluid under the water. Water foam consists of incompletely spherical films of water filled with air. In the experiment just described, mercury foam is produced, the partial spheres of mercury film being surrounded by and filled with water. The fact that they are bubbles may be recognized by their shape. They form the characteristic line or angle of junction with the mercury on which they rest. They are evidently filled with water, for when they break no air escapes. They can be contrasted with globlues that usually form upon the surface at the same time. These tend to run to the periphery of the vessel, and possess their characteristic spheroidal shape. Sometimes bubbles half an inch or more in diameter can thus be formed.

To demonstrate still further the analogy with water films, bubbles may be blown. A tube or pipette is filled with water. Its end is placed beneath the surface of the mercury, and bubbles are blown by forcing the water out of the pipette. As a rule, a far inferior effect is thus produced, but the method is of interest, and shows more clearly to what action the formation of these bubbles is due.

Finally, a flat film can be formed, such a one as water forms across the opening of a pipe or within a wire ring. A piece of copper wire about as thick as a steel knitting needle is bent at the end into a circle. The end must touch the wire at the bend, making a con-



BLOWING MERCURY BUBBLES—MERCURY FILM.

tinuous circle. By bringing the bent portion in contact with a globule of mercury and some dilute sulphuric acid on a saucer, the wire loop becomes amalgamated or alloyed with mercury. Then, by sweeping it through mercury overlaid by water, with a quick skimming movement, a film can be picked up. Water will rest on its upper surface. This can be removed with blotting paper, leaving a pure mercury film. It must be held horizontal. It immediately breaks if an attempt is made to bring it into the vertical plane. The loop should not be much over a quarter of an inch in internal diameter.

FALL OF A GREAT WATER TOWER.

In various parts of the country it has become common, in connection with local water works, to erect slender towers or stand pipes for the purpose of maintaining the required head or hydrostatic pressure in the distributing pipes. The common method is to erect a simple iron cylinder or stack of, say, 16 ft. diameter and a hundred feet or more in height, into which the water is pumped and held like a cistern, the lower end of the cylinder being connected with one of the water distributing mains. In our paper for October 23, 1886, we gave an illustration of one of these stand pipes, as erected at Victoria, Texas, the upper end of which, not being at the time filled with water, had been damaged by a hurricane.

We now give illustrations of the far larger stand pipe of the Kings County Water Works, located at Sheepshead Bay, near Brooklyn, N. Y., which, at 1 P.M. on October 7, 1886, suddenly collapsed and fell, while being charged with water during a preliminary trial of its strength.

This stand pipe was 250 ft. high, 16 ft. in diameter at its base and for a height of 70 ft., then tapering upward for 25 ft., and then rising 8 ft. in diameter. A very strong and substantial foundation of concrete had been constructed, 33 ft. in depth below the surface of the ground. On this the stand pipe was built, the contractor being H. S. Robinson, of Boston, Mass.

In the construction of the work, the steel plates were hoisted to place by a derrick worked from within the tower, as indicated in the illustration at the left, which shows the structure partly completed.

As before stated, the explosion took place at 1 P.M., when the neighbors were startled by a rumbling noise followed by a crash like that of thunder. There was a slight vibration of the earth, but it was all over in less than thirty seconds. The people thought it was an earthquake, and rushed from their houses in terror. The shock was felt in all directions within a mile or two of Sheepshead Bay. A cloud of dust was seen rising from the locality, and when it had floated away the water tower was discovered lying on the ground, with tons of steel plates scattered in every direction. Great volumes of water rolled from and around the prostrate structure, and in a few moments nineteen acres of land was submerged.

Some water had been pumped into the tower a week previous to the explosion, but the real test was not made until the day of the explosion. It was supplied from drive wells in the immediate vicinity. The large engines were set in motion at the pumping station shortly after 11 o'clock. Two hours later the great tank was nearly filled, there being 227 feet of water in it, which would make about 400,000 gallons. The pressure was then 127 pounds to the square inch. It was noticed then that the tower leaked in some places, and Mr. Robinson prepared to mount the narrow iron ladder that led to the top of the structure, and make an examination. He approached within about five feet of the tower when he heard a rumbling noise like that of a rushing train, as he expressed it, and the plates for a distance of twenty feet from the ground parted and let loose the water. Others describe it as like the explosion of a steam boiler. The volume of liquid rushed out with great force, and Mr. Robinson was caught in it. He was carried nearly fifty feet by the wave, and that saved his life. Almost in the same moment a large section of steel plate weighing a ton or more crashed down upon the spot where he had stood. Another section weighing five tons was thrown fifty feet in an opposite direction. Small pieces were tossed all around the base of the tower.

Meanwhile, the tower, supported by the wire cables alone, tottered for a moment and then fell with a crash and roar in a northeasterly direction. The heavy steel plate, bolts, and braces were broken, bent, and twisted like so much paper. The rush of the water had stirred up clouds of dust, and for a time the scene was concealed from view. People in the immediate vicinity thought that the dust was escaping steam. When Mr. Robinson recovered himself, he was floundering in three feet of muddy water. His hat, coat, pocket-book, and a number of papers were gone. He struggled to his feet and waded toward a dry spot a quarter of a mile away. Though considerably bruised, he was not seriously injured. His pocket-book and clothing were found some hours later near the wreck. The soil about the tower was of a sandy character, and the water quickly disappeared, except in places where the sand was mixed with clay. Several acres of rye that had been planted by Mr. Stephens disappeared after the explosion. No other damage was done.

The following from the contract gives the particulars of the structure. The general conclusion appears to be that bad work in putting up the great pipe and poor material were the causes of its failure.

ROBINSON BOILER WORKS, 28 STATE ST., BOSTON, October 6, 1885.

BENJAMIN F. STEPHENS, ESQ., *President:*

I will make and erect on a foundation prepared by you near Coney Island, New York, a stand pipe 250 ft. high, as described below:

Pipe will be 16 ft. diameter up to 70 ft., then in the next 25 ft. taper in to 8 ft. diameter. Bottom of $\frac{7}{8}$ in. steel, 17 ft. diameter. Bottom course connected to bottom by $6 \times 6 \times \frac{7}{8}$ in. angle iron, flange turned out; 15 braces on the inside.

First 5 ft. of pipe of $\frac{7}{8}$ steel, with 3 rows of rivets in vertical seam; 30 ft. of pipe of $\frac{3}{4}$ steel, with 3 rows of rivets in vertical seam; 15 ft. of pipe of $\frac{5}{8}$ steel, with 3 rows of rivets in vertical seam; 20 ft. of pipe of $\frac{5}{8}$ steel, with 2 rows of rivets in vertical seam; 25 ft. of pipe of $\frac{5}{8}$ steel (taper), with 2 rows of rivets in vertical seam; 5 ft. of pipe of $\frac{5}{8}$ steel (1st course above taper); 30 ft. of pipe of $\frac{1}{2}$ steel; 35 ft. of pipe of $\frac{3}{8}$ steel; 30 ft. of pipe of $\frac{5}{16}$ steel; 30 ft. of pipe of $\frac{1}{4}$ steel; 25 ft. of pipe of $\frac{5}{16}$ steel.

For the first 75 ft. the course will be all inside, so at that height the diameter will be lessened by the thickness of the plates.

In the taper, the course will be all inside, and above that they will be large and small.

All of the plates will be steel stamped 60,000 lb. tensile strength. All of the vertical seams above the first 50 ft., and all of the horizontal seams, will be double riveted, with sufficient lap to make a good job.

I will rivet on to the outside of pipe a ladder running from top to bottom. Lower half of sides of 2 in. by $\frac{1}{2}$ in. iron, upper half of 2 in. by $\frac{3}{8}$ in. bar iron, and rounds of $\frac{3}{4}$ round iron 16 in. long and 12 in. apart.

I will rivet to pipe three manhole frames, position as shown on tracing, also two nozzles on bottom course.

I will rivet on to pipe two balconies (one under each of the upper manholes) with wrought iron brackets and floor as shown on tracing.

I will furnish and attach to the pipe twelve guys of 1 in. wire rope—six of them 100 ft. from the ground, and six 25 ft. from the top; the understanding being that you are to furnish and put down the anchors for same.

I will put around the top a 3 in. by 3 in. angle iron, and on the inside of the 25 ft. of $\frac{7}{8}$ iron I will rivet 4 in. by 4 in. T irons to stiffen the same. I will also rivet on 12 (twelve) 4 in. by 4 in. T irons to strengthen the joints where taper section of pipe joins the straight. Each piece to be 10 ft. long, and extend five feet above each joint and five feet below, eight of these T irons on lower joint, and four on the upper.

Price for the "stand pipe" completed as above, water-tight, and to your satisfaction, $16,625 (sixteen thousand six hundred and twenty-five dollars).

In the above price I have accepted your proposition to do the teaming from the dock at Bay Ridge or Long Island City to stand pipe site of all the material and tools used in the construction of said pipe for $350 (three hundred and fifty dollars).

Signed, H. S. ROBINSON,
By J. M. ROBINSON.

FALL OF A WATER TOWER AT KANKAKEE, ILL.

During a gale of wind on October 14, 1886, the water tower at Kankakee was overturned. The wind began blowing very strongly in the early morning, and reached an estimated velocity of sixty miles an hour. By 9 A. M. the tower was observed to be swaying slightly; the vibrations increased until the successive wind gusts raised it on one side or the other several inches at the foundation. An unsuccessful attempt was made to arrest this movement by tightening the nuts on the anchor rods, but the tower soon fell.

We quote the following particulars from the Kankakee *Gazette*:

"As the gale grew stronger, the tower with each vibration lifted itself further from its bed. Meantime, the top of the tower inflated and contracted like the sides of a panting horse. Then the windward side collapsed, forming a pocket extending downward from the top twenty-five or thirty feet, and the fall of the tower soon followed in a direction from the wind.

"The tower was 124 feet high and 20 feet in diameter. It was constructed of plates of $\frac{5}{8}$ inch boiler iron, four feet wide and ten feet long, diminishing in thickness to No. 9 iron (one-eighth of an inch thick) at the top. It was intended to have iron rods across the top to act as braces and prevent a collapse. These were put on, it is said, but taken off for some reason. The tower was erected by the Sharon Boiler Works, of Sharon, Pa., under the direction of William Jones. The foundation was of stone and concrete, seven feet deep, about twenty-one feet in diameter, and rose about eight inches above the surface of the ground except on the side toward which the tower fell, where an excavation left the wall exposed for about a yard. Mr. Shannon, superintendent of the Water Works Company, computed the resisting or supporting capacity of the foundation at 160,000,000 pounds, while the tower when filled with water would have weighed only 22,000,000 pounds. Six anchor rods, two inches in diameter, extended from about six feet above the foundation into the foundation a distance of two feet, where they turned at right angles and ran laterally into the stone about two feet. One-third of the foundation, on the side toward which the tower fell, is broken down and sloughed off to a depth of three feet. Whether this crumbling began before the fall of the tower, or was caused by the weight of the tower as it leaned far over, we cannot say. On the windward side the rods were broken off."

John C. Hoadley.

On the 21st of October, 1886, death brought to a close the career of John Chipman Hoadley, of Boston, U. S., an American engineer whose breadth of attainments rendered him one of the leading men in the profession, especially in steam engineering, in which he was an authority equaled by few.

He was born in the State of New York in 1818, and his first engineering experience was in connection with the system of State canals, which was founded by the Dutch settlers in the seventeenth century, and increased from time to time as the needs of the day demanded. Leaving the State engineers' corps at the age of twenty-six, he became engineer for the construction and equipment of a number of mills at Clinton, Mass., devoting himself to the wide range of work necessary to build up a variety of industries, a task which could not be accomplished except by one possessed of unusual force, skill, and versatility.

Later, he became manager of a large machine shop in Lawrence, and for a number of years was engaged in the manufacture of locomotives and textile machinery. His experience with locomotives led him into an analysis of the dynamical relations which speed bore to the operation of engines; and the result of his investigations, partly mathematical and partly experimental, resulted in the invention of the Hoadley portable engine, which was probably the first application of scientific principles to the design of high-speed engines. These engines contained numerous radical features, since appropriated by others, notably the application of an automatic variable cut-off to a single slide valve, operated by a governor attached to the side of the driving pulley of the engine. We do not speak by the letter as to the exact limitations of Mr. Hoadley's inventions in this respect, as measured by the patents issued to him, but the fact remains that he was the pioneer in the successful application of the methods of construction of the Hoadley engine, which was manufactured in great numbers for many years.

During the later years of his life he separated from commercial and manufacturing affairs, and confined his attention to the practice of his profession in consulting engineering and as an expert in patent causes. In this latter capacity his services were held in highest repute, his retentive memory rendering an extended reading and wide experience tributary to a power of keen analysis which would set forth the measure of each patent's merits or the worth of the mechanical features of an invention.

His acquirements were not limited to technical matters, but extended through a wide range of general culture. The transactions of the American engineering and scientific societies contain frequent contributions from his pen; the members of the British Association may recall among these his paper on "American Steam Engine Practice in 1884," read at the Montreal meeting, and which was the first step in the recent polemical engineering papers respecting English and American railway practice.

Mr. Hoadley was always interested in public affairs, but he held few offices. He was, however, the engineer member of the Board of Health of the State of Massachusetts. He also visited England and the Continent in 1862, on the part of the State Government, making an examination of fortifications for the purpose of devising a system for American sea coast defences.

The professional work of Mr. Hoadley is shown by its influence over a wide range of engineering practice in mill work, applications of steam, sanitary engineering, and methods of expert evidence, rather than in any massive structures which bear his name as builder. In his personal address he was especially genial, and endeared himself to a large number of friends.—*London Engineering.*

Improved Lock for Firearms.

In our issue of December 11 we described and illustrated an improved lock for firearms, invented by Mr. Charles E. Goodwin, of Saybrook, O. We omitted one important feature: A single pull of the trigger will fire both barrels consecutively. By properly adjusting the arms of the sears, both barrels can be cocked at the same time and fired simultaneously or consecutively, as may be desired; or, when both are cocked, one can be fired and the other not.

RECENT TYPES OF THE GATLING GUN.

The accompanying illustrations represent improved Gatling guns; one mounted on a tripod and the other on a carriage, and showing different methods of supplying cartridges to the gun.

Fig. 1 shows a small six-barreled gun, mounted on a tripod. This gun weighs 78 pounds. It uses what is known as the Accles' positive feed, which eliminates the liability of the jamming of the cartridges, and which has increased the rapidity of fire to the extraordinary rate of 1,200 shots per minute. One hundred shots have been fired from the gun in two and two-tenths seconds. The fire can be made continuous, or the delivery can be made in salvos of 30 or 40 shots per second. The latter mode of firing would prove beneficial when the gun is being fired on shipboard in a rolling sea, a pointing lever being attached to the gun to enable the gunner to give it proper aim.

With the introduction of the positive feed to the Gatling gun, two kinds of high angle fire are made effective. These may be classed as direct and indirect; direct when the gun is aimed and fired at any elevated object; indirect when the bullets are fired up in the air, in order to hit the object in their fall. This latter mode of firing can be made very effective in getting men out of intrenched positions. Musket balls when fired from the gun at high elevations remain up in the air for 57 to 58 seconds, and when they fall they strike the ground with sufficient force to penetrate two inches of timber. This high angle fire greatly increases the power and value of the gun as a weapon of war.

The Gatling is the only machine gun that can deliver high angle or mortar fire, and is doubtless one of the most effective arms of its size in the world. Official reports say: "The feed is positive in action and entirely independent of the force of gravity. The feed is all that is claimed for it. It is believed the modified Gatling gun with the new feed has reached the utmost limit of improvement."

This light gun is designed for naval service, for mountain warfare, for cavalry service, for police use in cities for suppressing mobs, for use on board of railway trains, for protecting and guarding treasures shipped by express, etc.

With this new feed the firing and loading can go on uniformly and incessantly, even when the gun is worked by men inexperienced in its use.

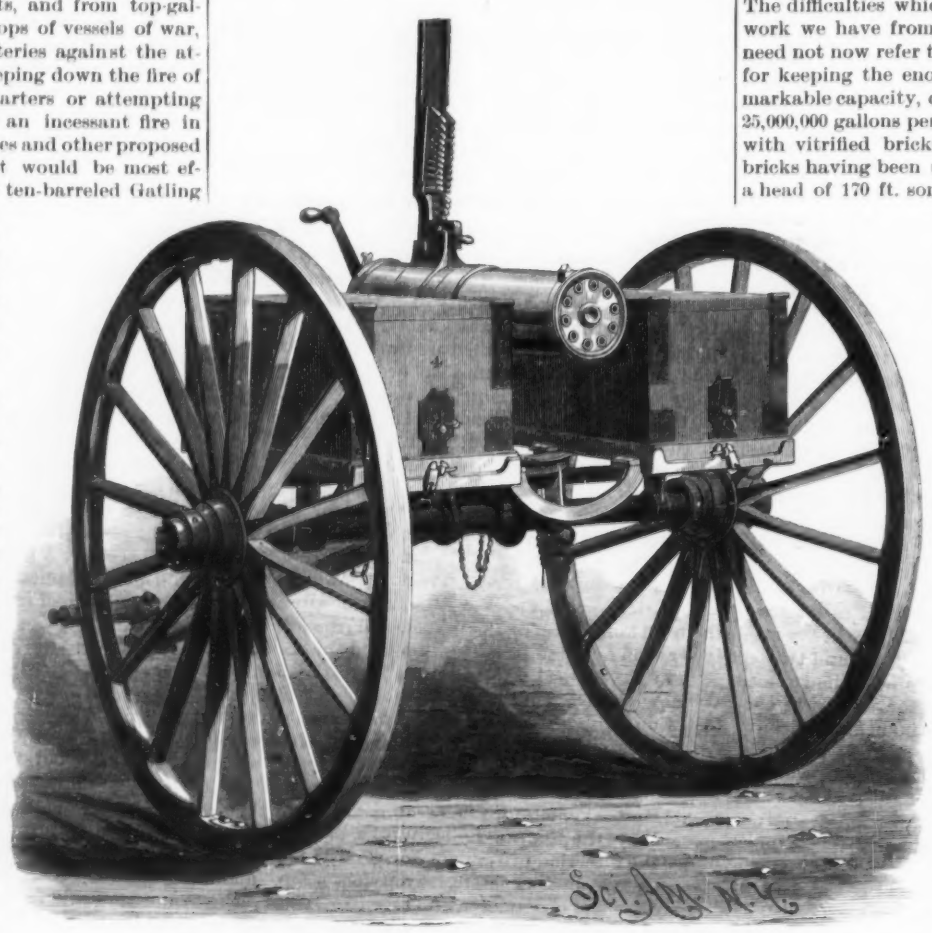
This gun would prove of great service in defending such positions as villages, field entrenchments, and for the defense of caponniers, for covering the approach to bridges or *tetes-de-pont*, for defending a breach, and for employment in advanced trenches, or in field works where economy of space is often of the utmost importance; for use on shipboard to clear the enemy's decks or open ports, and from top-gallant forecastle, poop deck, and tops of vessels of war, for the defense of sea coast batteries against the attack of boats, for assisting in keeping down the fire of ships engaging forts at close quarters or attempting to force a passage by pouring an incessant fire in their ports, and in clearing breaches and other proposed places for landing from boats, it would be most effective. Fig. 2 represents a light ten-barreled Gatling gun, mounted on a carriage. This gun uses what is known as the Bruce feed. This improved feed allows the cartridges to be fed to the gun at the rate of over 1,000 shots per minute, directly from the paper boxes in which they are originally packed. For continuous and direct fire this kind of feed makes the gun very effective. Various calibers of Gatling guns are made.

Among the advantages of the musket caliber Gatling gun may be enumerated: The lightness of its parts, the simplicity and strength of its mechanism, the rapidity and continuity of its fire without sensible recoil, and its accuracy and effectiveness against troops at all ranges attainable by rifles. Also its peculiar power for protecting roads, defiles, and bridges; for silencing field batteries and batteries of position; for increasing the infantry fire at the critical moment of a battle; for supporting field batteries and protecting them against cavalry or infantry charges; for covering the retreat of a repulsed column, and its economy in men for serving it and animals for transporting it. The relation which the machine gun is to occupy to the different arms of the service will, no doubt, ere long be prescribed and settled by competent authority.

The superiority and great value of the Gatling gun as an auxiliary arm of both the military and naval service having been clearly demonstrated, it is evident it will be extensively employed in any future wars.

The day is not far distant when machine guns in large numbers will be considered indispensable on the battle field, in forts, and on shipboard, and the nation that is best provided with these arms, and has its soldiers and sailors drilled to serve them in the best manner, will best preserve the welfare and lives of its people. Gatling guns are manufactured by the Gatling Gun Company, of Hartford, Connecticut, U. S. A.

NEW SIX-BARRELED GATLING GUN MOUNTED ON TRIPOD.



LIGHT TEN-BARRELED GATLING GUN ON CARRIAGE.

Scribner's Magazine for January, 1887.

The appearance of a new first-class monthly magazine, issued by a firm of such high standing as Messrs. Charles Scribner's Sons, under whose name had already been achieved one of the most conspicuous successes of modern magazine literature, is an event of considerable moment in the world of letters, and the contents and general style of make-up of the new monthly have been the subject of a degree of public attention seldom accorded to any literary venture. Of the first number it is to be said that the contents are all "good reading," and that the typography is excellent, the type being rather large, and of a style just calculated to suit the eyes of those who are beginning to think of wearing glasses. There is nothing to which we would award the palm of superlative excellence, either in the literary matter or the illustrations, but the whole is certainly up to the high average which readers of this class of literature have been favored with during the past few years, and there is about the magazine a look which seems to say plainer than words that it was not born of yesterday, and that it has come to stay.

Opening of the Severn Tunnel to Passenger Traffic.

On Wednesday, Dec. 1, the Severn Tunnel was opened to passenger train service. The ceremony of turning the first sod in the commencement of this, the most difficult bit of tunnel engineering ever entered upon, took place in March, 1873, now nearly fourteen years ago. The passenger service would, however, have been commenced some time since, but for the delay in the completion of the lines connecting the tunnel with the main system, a delay dictated by prudence when the stupendous difficulties in the prosecution of the work caused the delay in the completion of the tunnel itself, and some fear that considerable time might elapse before the whole of the difficulties could be overcome. The greatest caution has been exercised, and although the very able contractor, Mr. T. A. Walker, had completed the tunnel, the engineers deemed it advisable to start with goods service only for a short time. In his report to the Board of Trade, Colonel Rich says: "The works appear to be very good and substantial, and to have been carried out with great care and judgment. The difficulties of dealing with the large quantities of water, and particularly of dealing with the underground stream, which runs at a great velocity, have been considerable, but have been successfully overcome, and the result is a tunnel of unusually large dimensions which is particularly dry. The top of the tunnel is about 145 ft. under the level of high water spring tide, and about 50 ft. under the bed of the river at the deepest point. The means of ventilation are ample." The fan for the latter purpose, we may mention, is 40 ft. in diameter, and is made, like those for the Mersey Tunnel, by Messrs. Walker Brothers, Wigan, to exhaust 400,000 to 500,000 cubic feet of air per minute. The difficulties which have been encountered in this work we have from time to time described, and we need not now refer to them. The pumping machinery for keeping the enormous water influx down is of remarkable capacity, capable, it is said, of raising over 25,000,000 gallons per day. The tunnel has been lined with vitrified bricks set in cement, about 75,000,000 bricks having been used for this work alone; but with a head of 170 ft. some good work is necessary to keep water out. The passenger service was commenced without ceremony, as some connecting lines for the main service have yet to be made. This tunnel is about 4¼ miles long, and has cost nearly $10,000,000. For illustrations and full description see SCIENTIFIC AMERICAN SUPPLEMENT, No. 539.

MR. L. TIETJENS, of Stassfurt, Germany, has recently patented an ingenious method of damming back the flow of water in shafts by the application of the well known fact that certain salts increase their volume very materially by the absorbing of water of crystallization in hardening. To accomplish this, he takes either calcined soda, anhydrous alum, kieserite, or oxychloride of magnesium, mixes them into a paste, and then immediately injects them through a suitably arranged pipe into the fissures through which the water flows. It is said that as this paste hardens, it swells enough to fill all the interstices of the rock and to render it water tight.

TRICHECHUS AMERICANUS—MANATEE.

BY W. O. AYRES.

Strange-looking animals these are which we have here represented. They have been classed by some writers near to the whales, that is, among the cetaceans; and yet they are by no means closely allied to the cetaceans. And then, again, others have ranked them with the pachyderms, and in alliance with the elephants, etc. But the most recent writers, of suitable authority, set them by themselves in a designated group, to which is given the name of *Sirenians*. Of these are now existing but two genera, though one other has become extinct within a little more than a hundred years. These two are the *dugong*, *Kalicore dugong*, and the *manatees*, *Trichechus*, one species of which is figured for us here.

A common name, which is sometimes applied to them all, of the various types is sea cow; and the total disappearance of the sea cow of Behring's Island is a curious instance of the rapid and complete extermination of an animal of huge size, which at its discovery was abundant.

The facts are these: When Behring discovered the island to which he gave his name, a very large Sirenian fairly swarmed in the creeks and shallow waters of its shores. It was well described by Steller, the naturalist who accompanied him, and the specimens which he took home to St. Petersburg were, until quite recently, the only ones available. But in 1883 the Smithsonian Institution received from Dr. Stejneger a very valuable collection of skulls; in fact, almost complete skeletons. The animal was larger than either of the Sirenians now in existence—20 to 28 feet long. It constitutes the genus *Rhytina*.

Like all the Sirenians, it was very gentle and affectionate in its disposition, and Behring's sailors tamed them readily; but, alas! for the poor sea cows, their flesh was excellent for food, and the sailors took advantage of their gentleness, and by 1768 not a single *Rhytina* could be found on Bhering's Island—the only known place of their residence—and none others have ever since been seen. Steller's sea cow is, without doubt, extinct.

The *Sirenians*, as already noted, are of very peculiar formation. They have no hind limbs whatever externally manifested, resembling the cetaceans in that respect; but their fore limbs are very strong, large, flat, flipper-like, and remarkably flexible. The bones of the entire skeleton are denser and heavier than those of any others of the mammalia. The flesh of all is, like that of the *Rhytina*, much prized as an article of food.

The skin is coarse, heavy, and resembles that of an elephant, having short, stiff hairs scattered about on it, but nowhere thickly, the general color being dark, almost black. The eyes are small, the nostrils large, provided each with a valve.

These characters are common to the dugong and the manatees. Of the latter—*Trichechus*—there are two species, an African, *T. senegalensis*, and an American, *T. americanus*, which is the one before us, and of which only I will here speak.

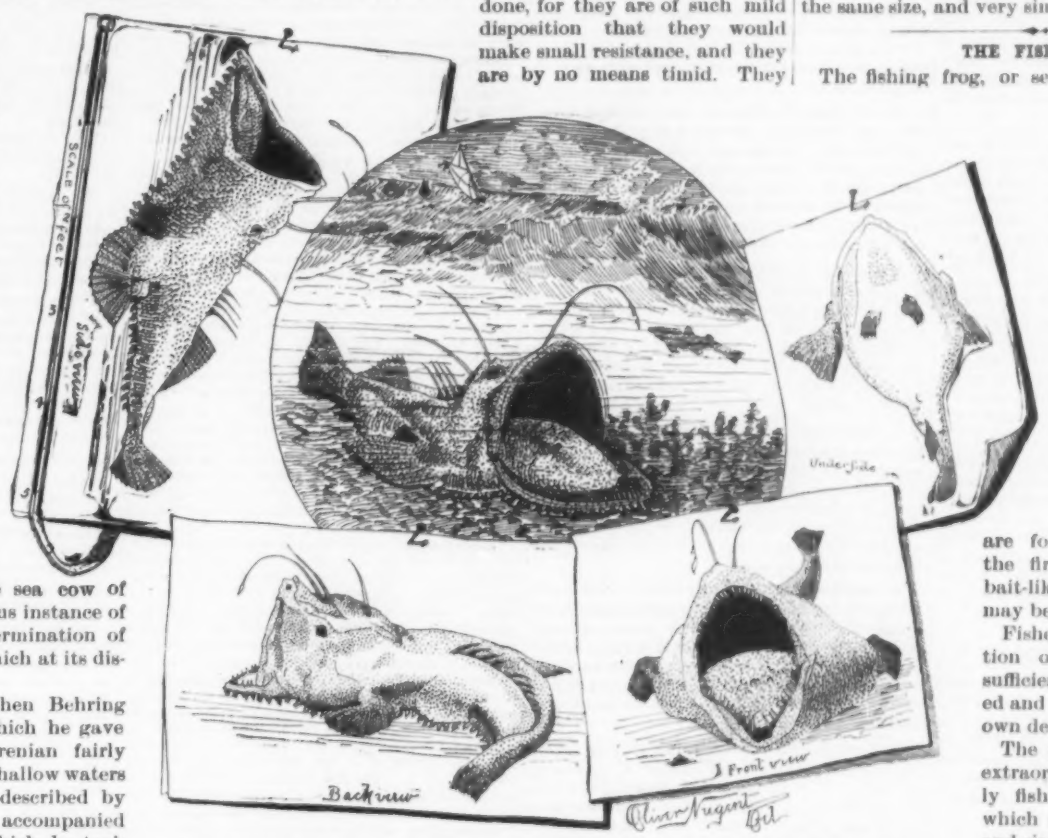
Trichechus americanus is a native of our whole eastern coast from the southern to the northern tropical limit and a little beyond, that is, from Brazil to Florida, including the West India Islands and the Gulf of Mexico. It should be mentioned that an attempt has been made to separate the northern type, those of Florida, as a distinct species, under the name of *Trichechus latirostris*, but it is perhaps more probably only a climatic variety.

The manatees have seldom been captured and brought away for exhibition, though it might easily be done, for they are of such mild disposition that they would make small resistance, and they are by no means timid. They frequent the shallow lagoons, and an easy arrangement of nets could capture them. Two small ones, about six feet in length, were exhibited in 1875, and one smaller still was shown only a month or two since by Messrs. Reiche Brothers, of New York, importers of such curiosities, from which our representations are made.

Its attitudes are well shown by the figures. It was said to have been brought from Brazil. It breathed in one to one and a quarter minutes, the valves of the nostrils opening as it rose to the surface and closing as it went below. This species grows to the length of 12 to 15 feet. It ascends the South American rivers freely, following the Amazon far up into the mountains.

The dugong is found in the Red Sea, the Indian Archipelago, Mauritius, Australia, etc.

It is closely allied to our manatee, and is of about the same size, and very similar to it in habits.



THE FISHING FROG (LOPHIUS PISCATORIUS)—A STUDY FROM LIFE.

THE FISHING FROG.

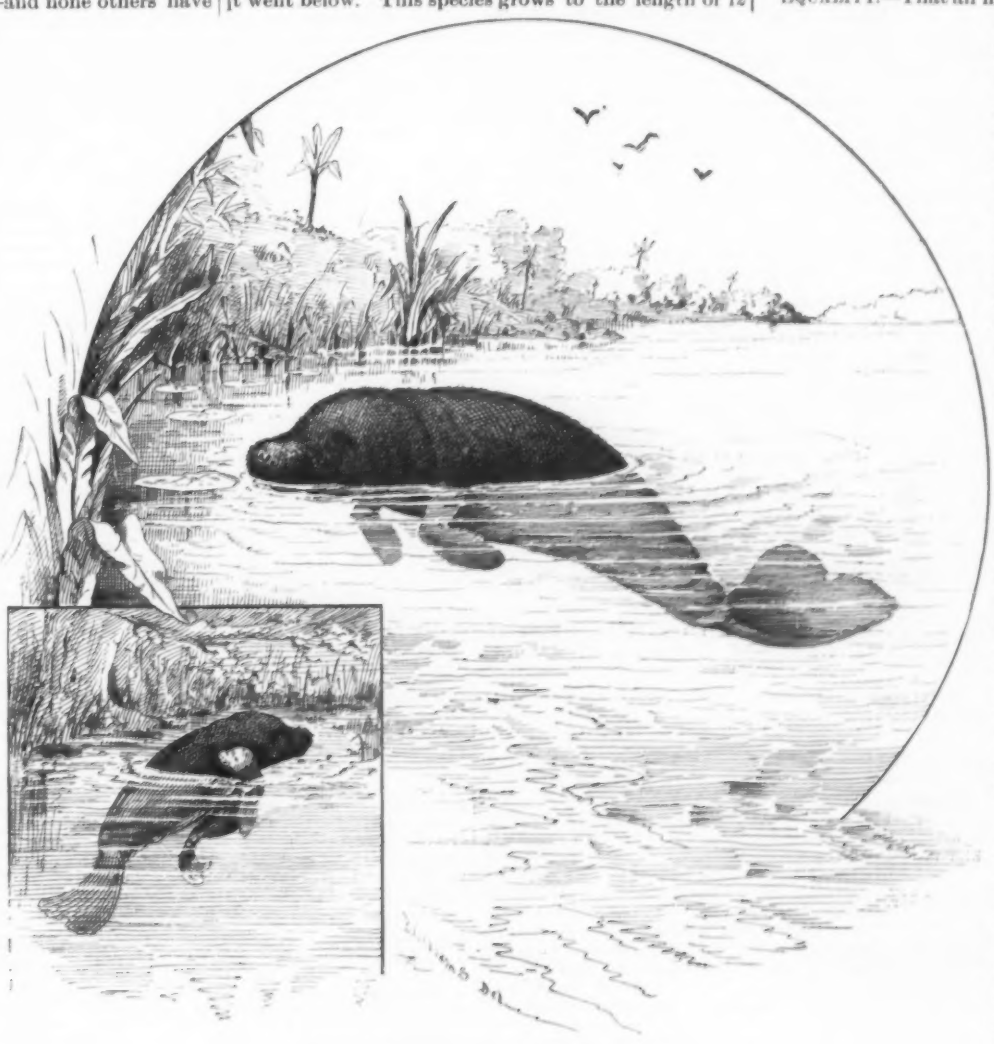
The fishing frog, or sea devil, as it is sometimes called, owing doubtless to its repulsive appearance, is conspicuous principally for its peculiar method of alluring its prey. Its head is of enormous size, and the feature that is not least pronounced is its prodigious mouth, which extends, not from ear to ear, but half way around the front part of its head, and is fortified with rows of teeth which may be raised or depressed at will, according as the prey is entering or striving to escape from its place of captivity. Along the top of the head are found three long filaments, the first of which terminates in a bait-like appendage, and which may be waved in any direction.

Fishes are attracted by the motion of this object, and when sufficiently near, the mouth is opened and the prey is sucked in to its own destruction.

The stomach is distensible to an extraordinary degree, and frequently fishes are discovered therein which are nearly equal in weight and size to the fishing frog itself.

The head is provided with a moss-like fringe, which extends around its entire circumference, and which enables it to conceal itself easily among the seaweeds and mosses on the bottom of the sea, where it is its pleasure and custom to extend and bury itself in wait for its victims.

The specimen from which the drawing was made was captured near Flushing, Long Island, by Dick Hill, son of the celebrated sporting man Harry Hill, of this city. It was 5 feet long, and weighed 125 pounds.



THE MANATEE, OR SEA COW.

EQUALITY.—That all men have equal rights is a cardinal doctrine in the theory of democratic government, but it is possible to expand the claim to a point beyond the bound of rights simply, and apply it to the results of the exercise of our inalienable endowments. Human beings are not born with equal gifts and powers. Wherever there is an upper and middle, there must be an under. The weak must seek the wall and be the stile from which the ambitious strong will vault toward the top. Nor can those appointed by nature for the pyramid's base serve in any other position. To press the wall as little as possible, get all the pay for service that it demands, and make the "best of now and here," is the bound of their possibilities. Without a foundation there can be no superstructure, and the position is as truly honorable as any other, though universal mankind have held it to be less desirable. All theories for the help of those who serve must proceed upon an admission of inequality.—*The Carriage Monthly.*

THE American Forestry Commission, at its annual meeting held at Denver, Col., September 15, recommended to Congress the establishment in the District of Columbia of an agricultural and forestry experimental station, and the passage of a bill for the protection of the government timber lands.

ENGINEERING INVENTIONS.

A car coupling has been patented by Messrs. Jacob W. Baker and George A. Prescott, of Dover, N. J. This invention relates to the construction of a novel form of drawbar and connections, to be used with the ordinary form of coupling link.

A boiler feed regulator has been patented by Mr. Charles O. Wyman, of Anoka, Minn. The invention consists of a tank with pipes connecting it with the boiler above and below the water line of the latter, and with pipes leading to the pump, with various novel features, to keep the water at all times at the proper height.

A reversing mechanism for engines has been patented by Mr. Lorin C. Forwood, of Shipman, Ill. It consists in an eccentric held between collars secured to the main shaft of the engine, with sliding wedges arranged to move the eccentric transversely across the shaft, by which the reversing of the valve motion is effected, without the ordinary joints and rods required where links are used.

An automatic water feeder for steam boilers has been patented by Mr. Charles O. Rabut, of New York city. It embraces a system of valves operated by a float controlled by auxiliary floats, and also in an arrangement of an air valve to permit the escape of air during the filling of the float chamber, all of the working parts being inclosed by a casing, except when registering mechanism is employed.

A valve for hydraulic elevators has been patented by Mr. Parker F. Morey, of Portland, Oregon. This invention comprises a system of differential valves controlled by an auxiliary valve, and thus governing both the admission and the escape of water from the ram of the elevator, with provision for arresting the motion of the ram, as required, to stop the elevator, the design being also to prevent excessive wear from sand or grit.

MECHANICAL INVENTION.

A machine for making whiffletree bolt blanks has been patented by Mr. John Stacker, of Winsted, Conn. In this machine a new form of anvil or die is employed, on which the heads of the bolt blanks are flattened, split, and spread or opened, in connection with a new device for splitting and opening the bolt, so that all the operations may be conducted with dispatch on the same machine.

AGRICULTURAL INVENTIONS.

A combined corn planter and cultivator has been patented by Mr. John C. Weiss, of Sheidon, Mo. The object of this invention is to improve the construction of a machine heretofore patented, involving novel features and combinations, to render the machine more convenient in use and more reliable in operation.

A harvester for sugar cane, corn, etc., has been patented by Mr. Samuel H. Pearcy, of Franklin, Tenn. This invention covers a novel construction and combination of parts in a machine to be drawn by teams on fields of standing crop, and automatically cut the standing canes and strip them of their tops and leaves, and drop them in bunches while passing along the cane rows.

MISCELLANEOUS INVENTIONS.

A rein muff has been patented by Sarah J. Hull, of Stella, Neb. One end has a flap secured to one side and constructed to be folded over the end and secured to the opposite side, so that the reins and whip may be held in the hands and the latter be at the same time protected by the muff.

A carpet stretcher and tacker has been patented by Messrs. Adelbert H. Noyes, of Jefferson, and Frederick G. Noyes, of White Water, Wis. It has a staff and barrel, to the lower end of which is attached a toothed carpet stretching and holding head, in connection with a tack holding tube, and a foot pedal so arranged that the tacks may be driven thereby.

A mould for soles and heels of boots or shoes has been patented by Mr. Darius Banks, of Morrisville, Pa. It is for forming the heel and sole together of rubber or other plastic material, by simply pressing the latter into the mould by hand and permitting it to harden, the form being shaped and withdrawn from the mould in a manner not attainable with a solid mould.

A clevis has been patented by Mr. Arthur W. Rumsey, of New Kiowa, Kan. It is more especially designed for attachment to agricultural implements or machines, and provides a simple, inexpensive, and effective device, which may be quickly and easily coupled or uncoupled, but which will not uncouple accidentally.

A moulding machine has been patented by Mr. Samuel C. Burris, of Victoria, British Columbia. It has upper and lower cutter heads for simultaneously surfacing and grooving opposite sides of timber, with cutters arranged at an angle to the line of motion of the timber, and other novel features, to improve the construction of woodworking machines.

A miner's safety lamp has been patented by Mr. August J. Becker, of Mount Carmel, Pa. The invention consists of various parts and details, making a lamp which cannot be opened by the operator without extinguishing the light, and in which the light is extinguished when brought into contact with the fire damp.

A facing tool has been patented by Mr. Alfred H Donnally, of Foxburg, Pa. The invention consists of a face plate carrying cutters and having ratchet teeth, a ratchet lever and pawl operating on the face plate, and there being a feeding device for the face plate, the tool being specially adapted for truing up the faces of oil well joints.

A combination ladder has been patented by Mr. Christian Koerner, of Rochester, N. Y. It is a step ladder connected with an auxiliary section by separable hinges, the auxiliary section having one or two additional sections, and one of the sections having a short ladder acting in conjunction with the section to form a trestle for supporting a stage.

An ax has been patented by Mr. Nicholas Goodier, of Dardanelle, Ark. The ax body has a transverse groove, and a deeper slot at right angles thereto, to receive a corresponding tongue and projection on a detachable bit, the parts being rigidly united by a bolt passing through the projection, so the cutting blade is detachable and can be renewed when worn or destroyed.

An adjustable balcony has been patented by Mr. Gottlieb D. Husemann, of St. Louis, Mo. This invention covers a novel construction of folding balcony, which can be readily removed and folded in small space for storage, especially designed in washing the outside of windows, being so constructed that it can be easily adjusted in operative position in any window of any story.

A bicycle handle has been patented by Mr. Robert Rodes, Jr., of Nashville, Tenn. Combined with the bicycle handles are curved levers pivoted thereto, having hooks on their shorter arms, which are received in holes formed in the under side of the cross arm, to which the handles are jointed, the invention being an improvement on a former patented invention of the same inventor.

A dumbwaiter has been patented by Mr. James Murtaugh, of New York city. It consists of two counterbalanced carriages arranged in the same shaft, one above the other, each having means for operating it independently of the other, thus making a waiter in which the upper carriage can be conveniently used for the upper and the lower carriage for the lower floors of a building.

A bag fastener and tag holder has been patented by Mr. Austin Leyden, of Atlanta, Ga. It has a plate with a hook or hooks, over which a tightened bag cord may be drawn, a plate with a slot to receive the cord, an adjustable latch bar, and other novel features, being especially adapted for use on mail bags of the second class and on bags containing general merchandise.

A feeding mechanism for grain, flour, etc., has been patented by Mr. Charles A. Andrus, of La Grange, O. It is a mechanism which secures a positive discharge from the bin, subject to regulation as to the amount of material passed out of the receptacle, and applicable to a large range of work, from the natural grain to the softest stock, which is fed so that it cannot sift or dust and waste.

An inhaling device has been patented by Mr. Marmaduke W. Hobbs, of Richmond, Ind. It is an inhaler or respirator in which an adjustable disk or valve is employed for regulating the admission of air into the instrument when in use, and for closing one of the air openings when not in use, there being shallow trays for holding the substances to be inhaled, and a removable air induction tube.

A window cleaner has been patented by Mr. Carl B. Von Schenk, of Frankfort-on-the-Main, Germany. The invention consists of a pad attached to a bracket secured to a block, with a powder holder secured to the bracket, and a detachable pad, being designed to clean and polish windows, looking glasses, etc., without the use of water, the specially described powder consisting of silicic acid, magnesia, aluminum, and sulphuret of calcium, prepared as set forth.

A piano forte damper cover has been patented by Mr. Emil Hofinghoff, of Barmen, Prussia, Germany. It is fastened to the back or to the bottom of a grand piano, and is hinged to the instrument so that it can be conveniently opened or closed by hand, and fixed to any desirable amount of opening, being designed to facilitate controlling the power and to improve the tone of the instrument, and also to guard against hurtful influences of temperature and dampness.

NEW BOOKS AND PUBLICATIONS.

ELECTRICITY IN THE SERVICE OF MAN. From the German of Dr. Alfred R. Von Urbanitzky. Edited by R. Wormell. 859 pp. London and New York: Cassell & Company.

This is a very comprehensive, popular, and practical treatise on the application of electricity in modern life, referring to and describing, with numerous illustrations, a large proportion of the hitherto published experiments and investigations in nearly all branches of electrical development. Part I. treats of the principles of electrical science, and Part II. of its technology, including generation and conduction, the electric light (noticing all the different systems that have attained any degree of success), electro-chemistry and metallurgy, electricity as a motive power, the telephone and the telegraph.

STEAM ENGINE CATECHISM. Part II. By Robert Grimshaw. New York: John Wiley & Sons.

This little volume, really issued as a supplement to a former brief catechism of the same author, is a continuation of the same style of giving information in regard to steam engine practice, through the form of question and answer.

PRECIOUS STONES IN NATURE, ART, AND LITERATURE. By S. M. Burnham. Boston: Bradley Whidden.

The author has put together in this volume 400 pages of very readable matter touching precious stones and their imitations, as a sort of supplement to his former work on "Limestones and Marbles," published in 1883. The chapters relative to collections of precious stones, crown jewels, and prices, trade, pawns, etc., engraving on stones, and their secular and sacred uses, are full of interesting anecdote and detail drawn from a wide field of investigation. Nearly one hundred pages are devoted to the diamond alone, and the appendix has tables of sizes of remarkable diamonds, and the relative hardness, specific gravity, and principal constituents of precious stones. The book has a full index.

Special.

A WELL KNOWN SOCIETY LADY'S LIFE SAVED.

Mrs. Colonel Fleming, an accomplished lady, well known in Philadelphia, in Western Pennsylvania, and in Washington, has been spending a considerable time in Philadelphia, preparatory to going to Washington, where it is understood she is to have her future home. Graceful in her movements, elegant in form, and the very picture of health in her features, Mrs. Fleming would not be taken for one who had suffered a long experience of illness, and who had so completely lost her health that her friends had given up all hope of her recovery.

The writer recently met Mrs. Fleming, and had a conversation with her as to her illness and restoration.

"For many months," said Mrs. Fleming, "during the protracted illness of my husband, which resulted in his death, I was with him night and day, undergoing a very severe strain, both physically and mentally. While he lived I was able to bear up under all this, but when he died then came a reaction, and I was taken with a severe catarrhal fever. This brought me down very low. After a while I rallied, but did not recover my health. I fell into a state of nervous exhaustion, with neuralgic pains almost beyond endurance. My head was so sensitive that I could not touch it with a comb. My hands were so disabled that I could not bar my own window shutters. I had difficulty in recognizing my best friends during some of the time while I was at my worst. Day and night I suffered more than I can tell. This was at my home in Franklin, Pa. Finding that the best physicians there were unable to relieve me, I came to Philadelphia to consult physicians who were specialists in nervous diseases. Following their advice, I went to the University Hospital, where I had a private room and the most skillful medical attendance. But it was in vain. From all this I received no advantage.

"Some years ago I had heard of what was then a new remedy, but was said to do wonderful things in the cure of stubborn and chronic nervous diseases. It was 'Compound Oxygen.' I thought I could do no worse than to try it. Unable to walk even a short distance, I went in a carriage to the office of Drs. Starkey & Palen. On reaching there I was so exhausted that I was unable to state my case to Dr. Starkey. After resting, I had a full conversation with him, and he gave me encouragement to hope that Compound Oxygen might give me some relief. It was with some apprehension of possible failure that my first inhalation was taken. But as soon as I realized what it was, I was delighted with the soothing and strengthening effect of the treatment. Dr. Starkey thought that in about three weeks some permanently good result might be expected. Rooms were secured near the office, for I was too weak and nervous to go any great distance, even in a carriage. I took the Office Treatment regularly every day. In about two weeks I experienced a marked improvement, which now daily increased. My exhausted brain began to be itself again, and my body received new vitality. With improvement came hope of entire recovery. For the first time since my husband's death I found relief from the pain and prostration which had borne so heavily on me.

"With changing weather, I would sometimes receive a partial setback for a few days. But this did not discourage me. Friends of mine, in Franklin, had been cured of severe and protracted illness, and why should not I? I kept regularly on for months, not as an experiment, for I found that I was receiving solid and practical good from the treatment.

"Not a particle of any other medicine but Compound Oxygen did I take. This was doing the work for me, and I determined to give it a fair chance."

"I suppose I need hardly ask you, Mrs. Fleming, if your health is now perfectly restored?"

"I am as you see me. I have neither ache, pain, nor weakness. I sleep well, and my appetite is hearty. I am as active as I ever was, and in as good spirits, and I lay it all to Drs. Starkey & Palen's care of me, and treatment with Compound Oxygen. Without this I think I should have been dead long before this. It is now nearly two years since I began taking the Compound Oxygen. If I should ever be sick again, I will again take it; but happily I have no need of it now."

The whole story of Compound Oxygen is pleasantly told in a little brochure of 200 pages, issued by Drs. Starkey & Palen, 1529 Arch Street, Philadelphia, Pa. This will be mailed freely to all who write requesting it.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Prof. Vose, in the preface to his "Manual for Railroad Engineers," says that Trautwine's "Civil Engineer's Pocketbook" is "beyond all question the best practical manual for the engineer that has ever appeared." See also Trautwine's "Railroad Curves" and "Earthwork."

A prominent mechanical engineer makes the statement that the loss from the absence of a covering from steam pipes and boilers is astonishingly large. One square foot of *exposed surface* of engine, boiler, or steam pipe, will condense, per hour, an amount of steam equal in foot pounds to one-third of a horse power. In available work, the loss is fully one-twentieth of a horse power per hour for each sq. ft. of exposed surface. In view of these facts, it behooves every user of steam to see that all his steam-heated surfaces are properly covered with a good, durable, non-conducting covering. For the past eighteen years the H. W. Johns Mfg. Co., of this city, has made a special study of this branch of their business, and are supplying materials which, for durability and efficiency, stand superior to all others in the market.

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Anti-magnetic shields—an absolute protection from all electric and magnetic influences. Can be applied to any watch. Experimental exhibition and explanation at "Anti-Magnetic Shield & Watch Case Co.," 18 John St., New York. F. S. Giles, Agt., or Giles Bro. & Co., Chicago, where full assortment of Anti-Magnetic Watches can be had. Send for full descriptive circular.

Complete Practical Machinist, embracing lathe work, vise work, drills and drilling, taps and dies, hardening and tempering, the making and use of tools, tool grinding, marking out work, etc. By Joshua Rose. Illustrated by 356 engravings. Thirteenth edition, thoroughly revised and in great part rewritten. In one volume, 12mo, 449 pages. $2.50. For sale by Munn & Co., 361 Broadway, New York.

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The Knowles Steam Pump Works, 44 Washington St., Boston, and 93 Liberty St., New York, have just issued a new catalogue, in which are many new and improved forms of Pumping Machinery of the single and duplex, steam and power type. This catalogue will be mailed free of charge on application.

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For softness she, and sweet attractive grace."

John Milton, in his "Paradise Lost," thus distinguishes woman from man. Diseases fail to her lot that do not to man's, peculiar to her soft and more refined nature. A remedy adapted to the cure of her peculiar diseases is found in Dr. R. V. Pierce's "Favorite Prescription," for women. Thousands who have used it attest its great worth.

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Iron Planer, Lathe, Drill, and other machine tools of modern design. New Haven Mfg. Co., New Haven, Conn.

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If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN patent agency, 361 Broadway, New York.

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We are sole manufacturers of the Fibrous Asbestos Removable Pipe and Boiler Coverings. We make pure asbestos goods of all kinds. The Chalmers-Spence Co. 419 East 8th Street, New York.

Curtis Pressure Regulator and Steam Trap. See p. 142.

Pat. Geared Scroll Chucks, with 3 pinions, sold at same prices as common chucks by Cushman Chuck Co., Hartford, Conn.

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Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Send for catalogue of Scientific Books for sale by Munn & Co., 361 Broadway, N. Y. Free on application.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) J. F. P. asks if a diamond will give light in the dark. A. No; unless by phosphorescence after exposure to sunlight or the electric arc light.

(2) B. D. asks how to preserve some mole skins without injuring the fur—an easy method. A. Supposing the skins are dry, they should be softened throughout by soaking in pure water; soft water is best, but any ordinarily pure water may be used, and care must be taken that the skins are thus soaked only a sufficient time to soften them. Then clean off any bits of flesh that may remain on the flesh side, rinse all well,

shake off the loose water, and gently stretch out and tack on a board, flesh side up. Then sprinkle with a mixture of powdered alum and salt, about two-thirds alum and one-third salt, enough to just cover every part. As the skin dries it takes up the mixture, but if any be left on the surface the second day, sprinkle on a little more water, otherwise put on more alum and salt, and sprinkle. Two to three days should be sufficient for such small skins, the idea being to give the skin all of the alum and salt it will take up, while in a moist condition. This tawing process makes the hair firm, a gentle rubbing and beating softens the flesh side, and it is preserved from decay, although tawed skins are never calculated to stand much wetting. This process is well adapted for all small skins, although those which are heavier require more time, and the flesh sides are sometimes folded together, and the skins rolled up. When the skins are freshly taken off, no soaking is needed, but more care is then called for in thoroughly washing off and cleaning them, and the first application of salt and alum should be in the proportions of one-half each. It requires the judgment of a tanner to deal with skins in a dry state which may have become partly damaged before drying, and it requires special knowledge also to tell whether a dry skin is so damaged.

(3) A. T. G. asks what is the process of fastening rubber rolls on clothes wringer. A. Clean shaft thoroughly between the shoulders or washers, where the rubber goes on. 2. Give the shaft a coat of copal varnish, between the shoulders, and let it dry. 3. Give shaft coat of varnish and wind shaft tightly as possible with five ply jute twine at once, while varnish is green, and let it dry for about six hours. 4. Give shaft over the twine a coat of rubber cement, and let it dry for about six hours. 5. Give shaft over the twine a second coat of rubber cement, and let it dry for about six hours. 6. Remove washer on the short end of shaft, also the cogwheel if the shaft has cogs on both ends. 7. See that the rubber rolls are always longer than the space between the washers where the rubber goes on, as they shrink or take up a little in putting on the shaft. 8. Clean out the hole or inside of roll with benzine, using a small brush or swab. 9. Put the thimble or pointer on the end of shaft that the washer has been removed from, and give shaft over the twine and thimble another coat of cement, and stand same upright in a vise. 10. Give the inside or hole of roll a coat of cement with a small rod or stick. 11. Pull or force the roll on the shaft as quickly as possible with a jerk, then rivet the washer on with a cold chisel. 12. Let roll stand and get dry for two or three days before using same. Cement for use should be so thick that it will run freely; if it gets too thick, thin it with benzine or naphtha.

(4) W. H. H. asks the best known receipt for purifying the best sweet oil sufficiently for watch oil. A. Put thin sheet lead into olive oil in a bottle, expose it to the sun for a few weeks, and pour off the clear liquid.

(5) J. R. S. asks (1) the composition of a cheap paint suitable for rough work. A. Grind powdered charcoal, oxide of iron, or any convenient pigment in linseed oil with sufficient litharge as drier, and thin for use with well boiled linseed oil. You will find it, however, cheaper to purchase a ready made paint from some reputable dealer. 2. A good work on the manufacture of paper from wood. A. See "Technology of Paper Trade," in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 109, 110, 116, 117, 118, and 123.

(6) A. R. H. asks the receipt for making the Sozodont tooth powder. A. Take of potassium carbonate ½ ounce, honey 4 ounces, alcohol 2 ounces, water 10 ounces, oil wintergreen and oil rose sufficient to flavor. 2. A good stove polish. A. Take of black lead pulverized 1 pound, turpentine 1 gill, water 1 gill, sugar 1 ounce,

(7) S. G. asks: Is there any way to mark white dishes permanently? A. We know of no means except by grinding suitable pigments in proper vehicle, painting the china, and then burning it in.

(8) L. S. B. desires a receipt for making a good black lacquer. A. Take of burnt umber 8 ounces, true asphaltum 3 or 4 ounces, boiled linseed oil 1 gallon; grind the umber with a little of the oil; add it to the asphaltum, previously dissolved in a small quantity of the oil by heat; mix, add the remainder of the oil, boil, cool, and thin with a sufficient quantity of oil of turpentine.

(9) D. W. McD. asks how to restore rancid butter so that it will taste and smell well. A. Wash well first with some good new milk, and next with cold spring water.

(10) A. H. W. writes: I want to have twelve triangles made from bar steel, each one to be of a different tone from the other. What sizes should each be, and what sizes of steel should each be made of, to make the best sounds? A. As you cannot depend upon getting steel of small and exact variations in size, your only course is to make a trial of a bar, and make a second trial with a shorter bar for the next note. Then make a trial on the next size steel. Commercial steel varies enough from its normal size to prevent any computation of lengths for chimes or chords or single notes.

(11) W. H. R. asks: 1. How can I construct a simple hygrometer to ascertain the moisture of a room when steam vapor is used? A. You may make a very good hygrometer by hanging a piece of well twisted catgut, that has not been oiled, to a hook with a disk or pointer attached to the lower end just heavy enough to straighten the catgut, using an eye of wire to keep it from swinging. The whole may be fastened to a small strip of wood, to hang upon the wall. The catgut may be a few inches or a foot or two long, according to the amount of twist. The index will swing with the hygrometric changes, and may be adjusted to proportional parts by comparison with a "Mason's hygrometer." SUPPLEMENTS 571, 334, 14, 379, 155. 2. Give me the best recipe you can for a casehardening compound, to be used on open fires. A. Casehardening in the open fire is a very poor and superficial process. We know of nothing better than a mixture of cyanide of potassium and hoof shavings thoroughly pulverized and mixed. 3. What is the best welding compound for working steel? A. There are a great many welding compounds in use, with as many claims to superiority. We have found nothing better than borax with a little sal ammoniac—about 10 per cent—all pulverized together.

(12) O. A. B. asks for a preparation or composition used to bleach hair. A. Use hydrogen peroxide, a description of which and its method of manufacture is given in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 184 and 239. Wash the hair thoroughly, and when perfectly dry, apply the bleach with a small sponge, rubbing well into the roots of the hair. Use as often as may be necessary to obtain the desired shade.

(13) J. T. C. asks (1) a receipt to bleach sponges. A. Soak in diluted muriatic acid 10 or 12 hours, then wash with water and immerse in a solution of hyposulphite of soda to which a small quantity of diluted muriatic acid has been added, and wash out. 2. How to kill ringworm or barber's itch? A. Wash the part affected with a little lemon juice; then rub in with the finger a little gunpowder which has been bruised in a porcelain mortar. Do this gently about twice a day. Be very careful not to make the skin sore. 3. A good receipt for hair dye? A. Take of silver nitrate 1 ounce, copper nitrate 1 drachm, distilled water 2 ounces. Dissolve the salts in the water, and add water of ammonia to the solution until the liquid becomes of a clear blue color.

(14) M. A. M. writes: I wish to preserve a portion of a polished steel surface and etch or eat away the remainder to a depth sufficient to receive a thick electro plate of silver, so that when plated, and the plating polished, it will be even with the preserved steel surface, so the whole surface will be even, but a portion steel and a portion silver plated. A. This is what is called electro inlaying, and is only successfully practiced by experts in this style of art. The etching process is the same as for engraving steel plates. The protecting material is asphalt varnish, which may be used with pencil brushes for ornamental work or for stopping off any parts not required to be acted upon by the acid. Asphalt, resin, and beeswax about equal parts, varied for hardness to suit the temperature, is suitable to cover the surface, warmed by dabbing with a small pad. This allows of the figure being scratched in with a point. Nitric acid 1 part, water 2 to 4 parts, is generally used for biting in the figures. This, followed by a dilute muriatic acid dip for removing oxide and cleaning the surface, will probably prepare the piece for electro plating. If not, you will have to make a study of chemicals that will clear the surface so as to take the silver; possibly a few trials cyanide of silver or potasso-cyanide may give you success. For electroplating, see details in SUPPLEMENT, No. 310.

(15) F. S. S. asks whether the last drops of a liquid dropped from a bottle are larger than the first, and why? A. The size of drops depends on the shape of the surface on which they form and on the rapidity of delivery. Hence they may be either larger or smaller when a bottle is nearly empty than when it is full, generally we think larger, because the flat surface of the mouth or lip is then the forming surface.

(16) J. G. asks (1) how to make a good cheap varnish for furniture. A. Melt 120 parts of yellow wax and a little pulverized resin, and compound this with 60 parts of warm oil of turpentine or spirits of turpentine. Rub the furniture with this by means of a woolen rag. 2. A receipt for cleaning window glass. A. Tie up some finely powdered whiting in a small piece of muslin. Dab it over the glass thoroughly. The dirtier the glass, the more whiting will adhere to it. Next smear it evenly with a damp rag, and let it remain until perfectly dry; then rub it off with a leather.

(17) W. G. S. asks: How is the bisulphide of tin amalgam prepared for frictional electric machines? A. It is not an amalgam. Powdered bisulphide of tin is spread over the greased cushions. An amalgam of one part of zinc, one of tin, and two of mercury is highly recommended.

(18) Lux asks: Is there any solution in which I can soak paper to make it a conductor of electricity when dry, also a method of putting an electrically conductive surface on paper? A. The electrically conducting solutions depend generally on the moisture they retain for their efficacy. For a surface, Dutch leaf or some metallic bronze powder is available.

(19) F. H. asks: 1. Will the micro-telephone, Fig. 5, described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 163, work on telephone described in SUPPLEMENT, No. 142, where no battery is used? A. The micro-telephone requires a battery. 2. Can a telephone made with permanent magnet be used with battery? A. It can. 3. Will it do to make bobbins of permanet magnet telephone of metal instead of wood? A. Metal is quite objectionable, as tending to shield or mask the current effects. Use wood or ebonite.

(20) E. B. asks: 1. Could water be heated to a temperature of twelve hundred degrees, that is, could a boiler be constructed strong enough, and a fire of ordinary coal be made hot enough to produce a temperature of twelve hundred degrees, no steam to be used, but simply to see how hot the water could be made? A. Water could be heated to any temperature short of dissociation. No boiler and fire could be constructed that would stand the pressure. 2. What would be the pressure per square inch on the boiler in above question? A. The pressure would be enormous. If steam space existed, it would be in the neighborhood of three hundred thousand pounds to the square inch (by Weisbach's formula). If it were solid water, the pressure would be still greater. 3. Would a tuning fork vibrate as long under an air pressure of ten atmospheres as it would under a pressure of one atmosphere? A. A tuning fork would vibrate longer in a vacuum than in air, and longer in one atmosphere than in ten.

(21) D. A. B. asks a receipt for dissolving mica, such as is used in stoves? A. Mica cannot be dissolved without complete decomposition. 2. In what way is rubber polished after vulcanizing, in the manufacture of combs and other rubber goods? A. By the ordinary finest grade of polishing powders, such as glass flour, emery, or rotten stone, and the use of cloth buffs or hand appliances to do the work. 3. Is there any method of preparation that can be used for coating plaster of Paris models that will leave the rubber smooth and bright after vulcanizing? A. Oil and blacklead and soapstone powder are recommended as facing for moulds. The SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 249, 251, 252, which we can send you for ten cents apiece, treat the subject exhaustively, more especially the last number.

(22) B. F. R. asks: Can you add any harmless substance to milk that would make a copious and permanent foam on being beaten with an egg beater? A. You might take the following, which is used with soda water: To each gallon add from two to four ounces of gum arabic dissolved in its own weight of water; or use the following: Quillaya bark 4 ounces, alcohol 4 ounces, glycerine 4 ounces, and water 8 ounces. Exhaust by percolation to make 1 pint of tincture. Two to five drachms of this tincture to be used to every gallon of fluid.

(23) G. F. asks why the planet Mercury is so much more flattened at the poles than the earth. A. There is no flattening of the poles of Mercury that has ever been measured, except at its transits, and then it is not observable in common telescopes. What you have probably seen is the gibbous phase due to its position in relation to the sun and earth. This might appear like an extreme flattening in a poor telescope.

(24) C. R. B. writes: I intend to make a dynamo three times larger than the one described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 161, and wish to know its capacity in furnishing a current for incandescent lamps (without battery). How many lamps of 20 candle power will it run, how many lamps of 24 candle power will it run, and how many lamps of 32 candle power will it run? Also please quote the additional lamps of 20, 24, and 32 candle power it will run with 6 medium sized Bunsen cells additional? A. A dynamo three times the size of that described in SUPPLEMENT, No. 161, would probably not run more than two or three 20 candle lamps. The six Bunsen cells would help it a little if used to charge the field. We do not recommend this dynamo for practical, every day use. We hope soon to describe a larger dynamo.

(25) B. L. R. asks how the ribbons used on writing machines, daters, etc., are made, that is, what material is used for making the different colors, how they are compounded, and how the ribbons are prepared. A. Take vaseline (petrolatum) of high boiling point, melt it on a water bath or slow fire, and incorporate by constant stirring as much lampblack or powdered drop black as it will take up without becoming granular. If the fat remains in excess, the print is liable to have a greasy outline; if the color is in excess, the print will not be clear. Remove the mixture from the fire, and while it is cooling mix equal parts of petroleum, benzine, and rectified oil of turpentine, in which dissolve the fatty ink, introduced in small portions by constant agitation. The volatile solvents should be in such quantity that the fluid ink is of the consistence of fresh oil paint. One secret of success lies in the proper application of the ink to the ribbon. Wind the ribbon on a piece of cardboard, spread on a table several layers of newspaper, then unwind the ribbon in such lengths as may be most convenient, and lay it flat on the paper. Apply the ink, after agitation, by means of a soft brush, and rub it well into the interstices of the ribbon with a tooth brush. Hardly any ink should remain visible on the surface. For colored inks, use Prussian blue, red lead, etc.

TO INVENTORS.

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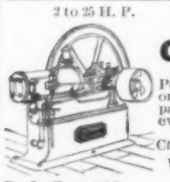

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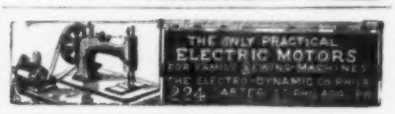

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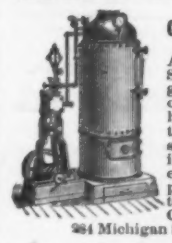

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TO THE STEEL MANUFACTURERS OF THE UNITED STATES OF AMERICA.

UNITED STATES NAVY DEPARTMENT,
WASHINGTON, D. C., Aug. 21, 1886.

The attention of all steel manufacturers of the United States is hereby invited to the requirements of the Navy Department in the way of armor-plates and heavy gun forgings, for the prosecution of work already authorized by Congress.

This advertisement invites all domestic manufacturers of steel to specify, in competition with each other, upon what terms they will engage to prepare for the production of and produce the forgings and armor-plate required for modern ordnance and armored ships; and no bids will be considered except such as engage to produce within the United States either all the gun-steel or all the armor-plate (or both) specified in this advertisement; nor will any bid be accepted unless accompanied by evidence satisfactory to the Department that the bidder is in possession of, or has made actual provision for, a plant adequate for its fulfillment.

Bids are hereby invited for supplying this Department with the under-mentioned material:

About 1,350 tons of steel gun-forgings, of which about 528 tons will be for guns of six inches caliber, 70 tons for guns of eight inches caliber, and 312 tons for calibers between ten inches and twelve inches (both inclusive).

These forgings are to be delivered rough bored and turned, and when in that state the heaviest forging which enters into the construction of a gun of each of the desired calibers will be about as follows:

6-inch	7¾ tons.
8 "	15 "
10 "	9½ "
10½ "	9½ "
12 "	17½ "

All these forgings must be delivered within the following times from the closing of a contract, viz.:

For 6 inch guns, 28 within one year, and the remainder within 18 months.

For 8 inch guns, within two years.

For 10 inch and larger guns, within 2½ years.

Preference will be given for earlier deliveries.

Also, about 4,500 tons of steel armor-plates, to be of the best material and manufacture, shaped accurately after patterns to fit the form of each vessel for which intended, and of such sizes as may be required, varying somewhat as follows:

20 feet by 8 feet by 12 inches thick.
17½ feet by 6 feet by 17 inches thick.
11½ feet by 4½ feet by 6 inches thick.

There will also be thinner plates.

For information concerning shapes and weights of the gun forgings and armor-plates, what parts must be manufactured in sets, time of delivery of each set, the chemical, physical, and ballistic tests, which the metal must sustain in each case, and for all other particulars, apply to the Chief of Bureau of Ordance, Navy Department, Washington, D. C.

Each bid upon armor-plate must specify the time within which the bidder will engage to make delivery; and preference will be given to earliest proposed deliveries.

Proposals must be in duplicate, sealed and addressed to the Secretary of the Navy, Navy Department, Washington, D. C., the envelopes indorsed "Proposal for steel gun-forgings and armor."

They will be received at the Navy Department until 12 o'clock M. on the 10th day of December, 1886, at which hour the opening of the bids will take place.

The right is reserved to waive defects in the form of, and to reject any or all bids.

Ten per cent. of the contract price will be retained from the payment for each article delivered, until the contract, as far as relates to articles of that class, shall have been completed.

Separate bids may be submitted for the gun steel and for the armor, if any manufacturer so desires; but bids covering both will receive preference, other things being equal.

Bids will be compared in two classes.

First. Gun Forgings.

Second. Armor-plate.

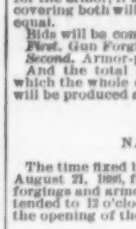
And the total sum for which, and the time within which the whole of the material covered by each class will be produced and delivered will be alone considered.

WILLIAM C. WHITNEY,
Secretary of the Navy.

NOTICE.
NAVY DEPARTMENT,
WASHINGTON, *November 6*, 1886.

The time fixed by the foregoing advertisement, dated August 21, 1886, for receiving proposals for steel gun-forgings and armor-plates, viz.: December 10, 1886, is extended to 12 o'clock noon, March 15, 1887, at which hour the opening of the bids will take place.

WILLIAM C. WHITNEY,
Secretary of the Navy.



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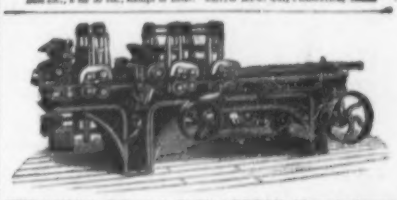

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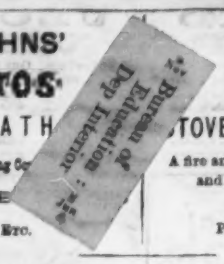

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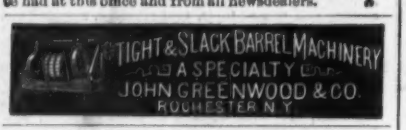

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